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MARCH

# THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

Pulpless Tooth and Its Treatment—*Stewart*
Periodontia and General Practitioner—*Tracy*
Empiricism in Dentistry—*Nesbett*
Gold-Nickel Alloys—*Shell*
Oral Syphilis—*O'Leary*
Tooth Form and Arrangement—*Schwartz*
Gnathostatic Diagnosis of Simon—*Hillyer*
Partial Denture Construction—*Sears*
Shortening of Upper Incisor—*Willman*
Maxillary Sinus—*Schultz*
Blood Chemistry and Periodontia—*Miller*
Dental Anatomy—*Diamond*
National Board of Examiners—*Conzett*

EDITORIALS
Into the Heart of Things
State Officers Conference

DENTAL THERAPEUTICS
Scope of the Council

DENTAL HEALTH EDUCATION
Romance in Dentistry—*Thomson*
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A. E. BONNELL, D.D.S., Muskogee, Okla.
Vice President of the American Dental Association

UNIV. OF MICH.

# THE JOURNAL
## *of the* AMERICAN DENTAL ASSOCIATION

Vol. 17 MARCH, 1930 No. 3


## *Original Communications*

# THE PULPLESS TOOTH AND ITS TREATMENT


By HOWARD TEMPLE STEWART, D.D.S., New York City



*Undoubtedly the retention of diseased teeth has been accountable for much ill health, a fact which the dental profession has for years been trying to impress upon the medical profession and the laity; but there are two aspects of this subject which at this time call for consideration. One is that the rôle played by teeth as a causative factor in disease has been exaggerated in recent years out of all proportion to the facts, and the other is that pulpless teeth are not necessarily diseased.*

*There is nothing more certain in all human experience than this and the prediction is here made with the utmost confidence that these facts will be demonstrated beyond any possible doubt both clinically and experimentally in the near future.*—C. N. JOHNSON.


A BRITISH writer, in commenting on the learned discussions on pulpless teeth, says, "We feel with Omar:

. . . and heard great argument
About it and about: and evermore
Went out by the same door wherein I went.

And we get a bit weary going in and going out of the same door with nothing to show for it. The result of such discussions often reminds us of:

Think so because all others think so;
Or because—or because—after all, we do think so;
Or because we were told so, and think we must think so;
Or because we once thought so, and think we must still think so;
Or because, having thought so, we think we still think so.

C. F. Rumsey, of Cambridge, England, says: "You will, I am sure, agree with me that the future of our dental art depends in no small degree upon our ability to render the pulpless tooth a safe inhabitant of the mouth." It would be difficult to condense into fewer words the thought that is so pregnant with meaning and so significant of the dental dilemma—and a dilemma it is.

The great Brophy said, "I regret to state that the appalling sacrifice of teeth

extracted by dentists on advice of physicians marks a dark, dark period in medical and dental history. This is the outstanding retrograde movement in these professions in the last quarter of a century." "Retrograde" is right! Retrograde, indeed! Orton speaks of "the frenzied extraction of devitalized teeth." Stoll says, "It is disheartening to see to what a pitiful state the hysteria of focal infection has brought dentistry. Dentistry is bankrupt. Valuable organs of mastication are being slaughtered in the name of an unfounded theory, and we are going back to pulling a tooth as the only remedy for dental ills." And, indeed, it looks as if we were headed that way. We have gotten started and we are not able to stop in our mad panic-stricken flight.

We find ourselves (as Thomas L. Gilmer says) much as the boy of the old old story, who yoked himself up to a yearling that was running away with him. As he was hitting the ground in high places trying to keep up with the yearling, he shrieked out, "Stop us! Damn us! Somebody, stop us!" We are hitting the high places at every jump, trying to keep up with our end of the yoke; but who is the "somebody" that is going to stop us! Johnson has tried, time and time again, but it is like a cowboy on the plains trying to stop a herd of stampeding Texas cattle.

Hopeful is the following, as opposed to the "Hunter" mania. "In a letter to the *Lancet,* Sir Chichester Gould May, medical specialist, says, 'Since X-raying of teeth came into fashion, the tooth-extracting mania is worse than ever. Judging by my experience, everyone whose apparently sound teeth are x-rayed is said to have diseased ones. Two of my patients recently went to an oculist. He had their teeth x-rayed. A patient went to an aurist and one to a laryngologist; they had their teeth x-rayed also. The verdict in each case was that several teeth ought to be extracted. All these patients had more or less recently seen their dentists, who had found nothing wrong with their teeth. I am informed that continental medical men do not attribute anything like the same importance to the condition of the teeth as we do, and think we have gone crazy on the subject. I am disposed to agree with them."

That is the meat of the coconut—a remarkable summing up—keen, brilliant, cutting, the words go straight to the heart and lay bare the hypocrisy, ignorance and hypno-insanity of the unfortunate situation.

Wilkinson, of Australia, said, "Centering around the pulpless tooth we have problems that have occupied the minds of most of the dental profession—in fact, one might say, of the medical profession. Specialists of all kinds are attracted to it and, like moths around the candle, their encounter has not always been too happy."

Nor, may I add, have been the encounters of those who have tried to follow their teachings.

For many years, I had tried to save and make useful pyorrheic teeth in the last stages—teeth which were usually considered hopeless, and in mouths in which full upper and lower plates were advised. This could be done only by cutting the teeth off, giving them surgical rest and using these pulpless teeth for abutments.

All this led to the devising of a special form of removable bridgework intended to be adapted to these cases. I built up a house with which I was very much satisfied until Price, Rosenow and Company came along and utterly shat-

tered my entire edifice. The bridgework that I had devised had for its foundation pulpless teeth; and so the chief work of my professional life seemed to come to a standstill. Even if I was not convinced that the pulpless tooth was causing a reasonable proportion of the ills that were being ascribed to it (and here I will take occasion to say that I was not), still I was afraid to say so, and I was afraid to continue the kind of work that I had been doing.

Besides, I was convinced that my pulp

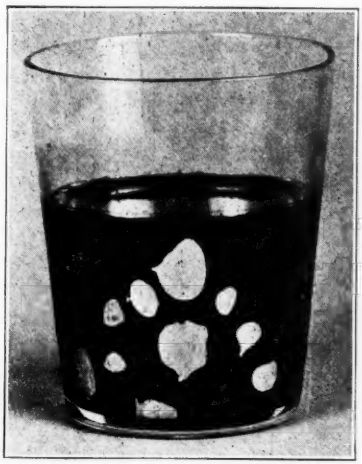


Fig. 1.—Wine glass filled with methylene blue for more than a year. Against the inside of the glass portions of the filling material were simply pressed with the finger, and the methylene blue was then poured over it. Water was added from time to time to compensate for the evaporation. The contents of this glass have been tested numerous times, and no sign of leakage has ever appeared. If the filling material will not leak when simply pressed against the side of a glass, how much less liable it would be to leak when surrounded by four walls of a tube into which it was pressed.

canal treatment and the treatment of the bone beyond the canal had been wofully deficient and that a certain proportion of the diseases claimed to be caused by the pulpless tooth were assuredly thus caused. Moreover, I became convinced that even in cases in which definite disease was not established, there was an undue tax on the system from many of these teeth because Nature had constantly to overcome toxins caused by the presence of these teeth. I was convinced also that we had no filling material at our command to meet the requirements.

I had long realized that drainage of infected bone through the canal was an impossibility when handled in the usual way and that infection was being taken care of, not by drainage as the surgeons require, but by the goodness of surrounding tissue and the grace of God—if at all; and I began to wonder:

Fig. 2 (Case 3).—Bicuspid about one year after treatment.

If surgeons opened wide their tissues in bone infection, why we religiously avoided doing the same.

If surgeons kept these wounds open weeks at a time for drainage, why we were instructed to close up the canals at the earliest possible time—ten days at the latest.

If the surgeons did not have to have a bacteria-free wound to close, why we had to have one.

And then I began to wonder, if Miller held infection to penetrate only about one two-hundred-and-fiftieth inch from the canal wall, why it was not good sur-

gery freely to ream out the root, removing the tubuli and their infectious contents, at the same time really cleansing the canal of pulp contents as cannot be done in any other way. And so it came about, after many days, that I began to open wide both the canal and the foramen, to incise the periosteum and open into the myeloid matter, contrary to all orthodox dental teaching, but (as I see it) not contrary to surgical teaching and procedure; for it is by such procedure (free drainage from the myeloid matter through the incised membrane) that surgeons get rid of necrotic and infectious material in the bone.

Can you imagine a more effective way to cause infection than to fill this root and leave this putrefying débris? If we wished to inoculate the peridental membrane and bone, could we possibly devise a more ruthless and efficacious method? I think not. And if you doubt that we usually do this, just stretch a rubber cap over an extracted root so you will work in the dark (as in the mouth); take all the measurements and precautions you wish to, and see whether you can efficiently clean out that root canal without carrying débris through the end of that root. And when it is through, *it stays*—we cannot get it out again unless we cut freely through this root end and through the membrane so we can *swab* it out as any common-sense surgeon would swab out a wound.

And you say that the peridental membrane is of low vitality, when it recovers from such treatment as it usually receives and the sealing in of this putrescent matter? A condition abhorrent to sane surgery. Why, I tell you it would seem to be the hardiest tissue in the human body, to have the greatest recuperative power, and to be the hardest of all to die. It seems nothing short of a miracle that we have been able to keep these teeth at all when so treated.

And so our first step must be a foramen well opened for drainage. But to close this wide open foramen and proceed successfully, it was clear that no filling now at our command would answer. Hatton and his co-workers have given over the successful filling of a large foramen as hopeless. They say: 1. "Unusually large canals react unfavorably." 2. "As far as we know, attempts to fill them always fail." 3. "Molar root end infections occur oftener on large (filled) canals than on small, tortuous, inaccessible canals."

And why? Because it is impossible in these small canals to inoculate the apical

Fig. 3 (Case 4).—Left: First permanent molar in a 16-year old boy. The pulp had been dead for probably two years. Center: Distal root and one mesial root filled. Right: Both mesial roots filled. About two months elapsed between the filling of the distal root and the last of the mesial roots. There is separation of the metal at the apex of the distal root. This has occurred very quickly, owing, probably, to rapid growth of the tissues of this young patient.

tissue. Not because of the "mechanical or chemical" irritant do large canals give trouble, but because the débris and putrescin are carried through into the membrane and bone and then not given drainage. If the crooked inaccessible canals, the ones we cannot get into, do better than those we can enter, what is the use of trying to clean out and fill a canal at all? All our treatment and filling comes to nothing. We then come back to purely and simply embalming and leaving Nature to take care of root end tissues by simply walling off infection, which she often does, just as she walls off infection in other tissues of the body. But for the marvelous power of apical tissue to do this, all our root canal filling in the past would have come to naught and have been done away with. This is all that saved us and our canal treatment: Nature took care of it, and we fooled ourselves into thinking that it was our skill. A radical change had to be made —something had to be done—something had to come along to make us work out this root canal problem; for it had completely demoralized dentistry, and had given the medical men cause again to say that we were mere mechanics, and that even our mechanics had only proved how shallow we were and how little we were prepared to deal with the human organism. (But let us not think that the medical profession has not made just as great mistakes with their problems as we have with ours.) However, I have no quarrel with the physician. The physician is more anxious than the dentist to have his patient's teeth preserved, to help improve that patient's health. He would be only too ready to advise against extraction if he could be reasonably sure that the tissues could be made and kept healthy; but when he is shown by our own men what kind of treatment is usually received, and the results thereof, he would be entirely without conscience

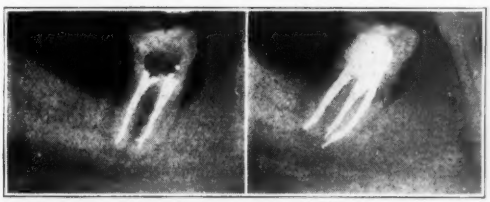


Fig. 4 (Case 8).—A lower molar filled as nearly as possible "just to the end" of the roots. This shows how admirably this material is adapted to fill a tooth either to the foramen or through it. In other words, if an operator prefers not to fill through the root, this material is far superior to any other to use for this purpose as it can be perfectly controlled. This was a case with a freshly extracted pulp, arsenic having been used. It was purposely done in this way (filled about to the end only), as it seemed favorable, for this kind of procedure; but as a general practice, it is distinctly not advisable, for, in all such cases, there has been little drainage of the apical tissues, and as débris is inevitably carried through the foramina (if the canal is really cleaned), there is a chance that some rarefaction may take place in the future. Left: Distal root and one mesial root filled. Right: Distal root and both mesial roots filled. The view to the left gives the impression that the mesial is not filled to the end; but the view to the right shows that all three are entirely filled. At the left, it is the unfilled mesial canal that is longer than the filling. This is a case that most men would select as one of the best treated teeth in the lot. With this the author does not agree.

if he advised treatment according to these methods.

Is it not so? Why, then, should we blame the physician? He is advising according to the light we have given him. Convince this man that the bone is drained, the source of infection stopped, and that new tissue forms as happens when *he* treats a bone infection, and he will be far more anxious to have teeth treated than the average dentist will be to treat them—meaning, of course, to treat them with the thoroughness and surgical accuracy that the surgeon uses with his own cases of bone infection.

Rickert, of Ann Arbor, says, "There is unquestionable evidence that we must soon either refine our root filling technic or abandon the practice." I would not put it quite so strongly as that, but assuredly we will have to show the physician a saner and more definite procedure than we have in the past, and one more in accord with his surgical and therapeutic sense, before we can again enlist his cooperation. He has kicked out of the traces, and is going to be hard to harness up again. But, the average dentist is far worse. He has slipped the bridle and run away, and he is not going to be caught again if he sees us first.

Of course, Rickert was not referring to the successful and splendid work of our best men. He meant to refer only to what he himself has called "inadequate, miserable root canal surgery," which, sad to relate, is the rule.

It is well to keep in mind the following statement by one of the ablest scientists of our time, E. W. Fish, of London, who says: "Bacteriological investigations of treated root canals give us no indication of the surrounding bone . . . radiographic investigation is unsatisfactory . . . old bony changes easily seen by the x-ray may have become sterile . . . even the apex of a denuded and absorbed root end may prove sterile."

I have scarcely touched on the opening of canals or the use of antiseptics. Grove says that he believes the chief cause for infection about teeth filled to the apex to be the deleterious remedies used, meaning that these remedies reach and destroy the membrane because the canal is opened to the apex; and, because those not filled to the apex show better results, he draws the foregoing conclusion.

On the contrary, the cause is, in my opinion, that these teeth are opened "just to the apex" or a little beyond. Thus, infectious and mechanically ir-

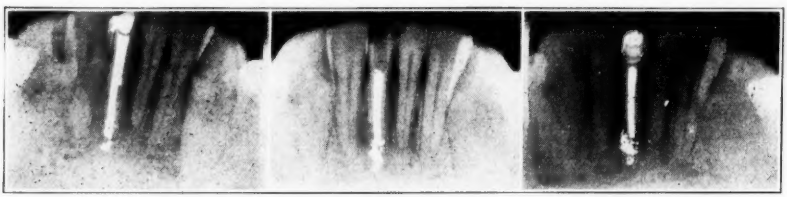


Fig. 5 (Case 9).—Progressive filling in of the tissues and the movement of the metal. Right: Metal cut off cleanly even with the end of the root. This tooth had been pulpless several years. The roentgenogram revealed little or no rarefaction. There is always some, the result of instrumentation and of drainage of the tissues. The healing in of these tissues accounts for the movement of the metal seen in the pictures. The metal has moved out to the side of, as well as away from, the apex of the tooth.

ritant material is carried through the foramen. Again, the placing of gutta-percha cones or other material may also force some débris and infectious material to or through the foramen. Neither of these conditions is so liable to have occurred in those roots that were only partially filled.

But what is to be done? My reply is "Open the foramen thoroughly and drain the tissues through it. Wash and wipe out the wounded tissues, as a surgeon would wipe out extraneous matter from any wound. Then, after thorough drainage and healing, fill the canal: and I mean *fill,* not just indulge in foolery as is usually done with guttapercha.

Grove has done invaluable work, for which we are so much indebted to him that I know he will not mind the criticism of this point in which, I believe, he has drawn the wrong conclusion. I quote him in this respect because he is a leader, and the opinion he expresses as to the cause of infection about teeth filled to the apex represents the opinion that is held by the majority of men.

Moreover, I believe he is largely correct in the opinion that the continued use of strong antiseptics that reach to and through the apex does destroy the vitality of the tissue cell. This is where we want drainage and not antiseptics.

Gratrix, of England, pleading for a more common sense antisepsis in dentistry, says: "The removal of bacteria is not, and should not be, our only consideration, and the protection of the cells from overionization should be safeguarded."

He quotes White-Robinson: "I am convinced that the scientific method of healing a cell, no matter where situated in the body, and no matter by what means injured, is to concentrate upon restoration of the cell, and to neglect the bacillus absolutely." White-Robinson investigations are referred to as profound. Gratrix, speaking of the great advance in surgical methods, urges us "to apply this tremendous experience to dental surgery—a sphere in which the physiological principles of repair seem scarcely to be heeded." Well spoken!

F. W. Wilkinson, of the University of Melbourne, in a masterly résumé of the pulpless tooth, says: "It is well to realize that Nature does not demand absolute sterility, and it has been shown that the deep healthy tissue is not always sterile."

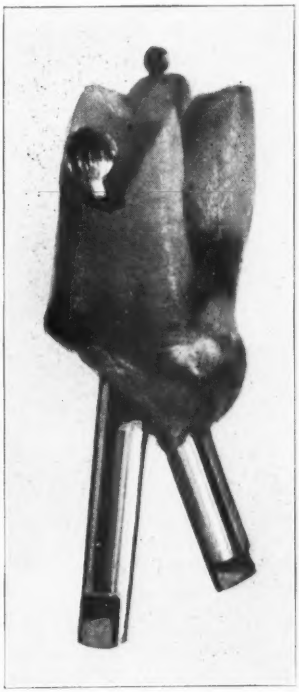


Fig. 6.—Method of reaming out the apex for free access.

Blair (author of "Surgery of the Mouth and Jaws") strikes the keynote: "The most powerful antiseptic we have at our disposal, one upon which, consciously and unconsciously, we are almost entirely dependent for overcoming every infection, is the activity of the living tissue cells. Our hope of eliminating infection from such cavities is not the use of chemical antiseptics, but in maintaining the health of the exposed cells."

Here, I call attention to the crux of the dental dilemma as seen by Hatton: "Further, we have said, and still say, that the presence of infection in any region cannot be determined solely by bacteriologic methods. The presence of bacteria anywhere in the body does not necessarily indicate infection; there must be a reaction between the tissue cells and bacteria. On this account, we maintain that the only sure method by which to determine infection at the apex of a tooth is the anatomic; either a study of the gross anatomic condition or a similar study of the microscopic conditions around the apices of the teeth in question. Using microscopic anatomic methods, we have been able to demonstrate that many human teeth that have been treated and filled are without histologic evidence of infection. But not only this; we have been able to demonstrate, in part, both the steps in the progressive involvement of the periapical tissues in infection and those in the healing of this region after treatment and filling of the pulp canal."

This demonstration is of the utmost value. I believe it is the keynote to the pulpless tooth problem. It is indeed a ray of light in the darkness. It is a message of hope and is like wine to our drooping spirits.

Hatton says further (and these words are no less important):

"In the mass of material that we have examined, there are many instances in which healing has not occurred. The reasons for this are usually very obvious; namely, selection of unsuitable cases; the presence of persistent or introduced infection, or inexcusably poor technic in carrying out this operation. We feel that this problem is no longer our problem except as it concerns relatively unimportant details. This problem now belongs to the practicing dentist. Can he develop an accurate, aseptic, scientific technic for treating and filling root canals?"

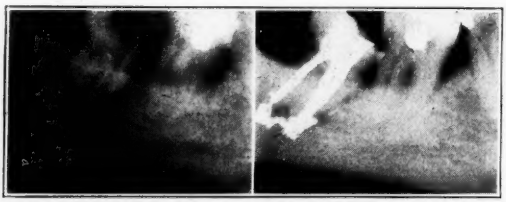


Fig. 7 (Case 12).—Lower third molar with rarefied area about the apices. Right: Same molar several months later, with the three canals filled.

This is a manly, fair, square, straight-from-the-shoulder proposition. It breathes fair play. He comes out in the open and throws down the gauntlet to the dental profession. We accept the challenge.

Again, he says, "I cannot at this time definitely answer the question 'Should practically all pulpless teeth be extracted?'" We are going to answer that question for him.

We come now to the filling material. Surgeons have proved that certain metals are tolerated by the vital tissues. These experiments by the surgeons refer to solid compact metals such as iron, steel, aluminum, lead, gold and silver. It is to be noted that experiments show that while the tissues, others, such as silver, gold and tin, do not tarnish or change in any way, nor irritate the tissues.

Experiments show that metals are tolerated in the jaw bones as nowhere else in the body, and that, too, where it is impossible to obtain a sterile field as in other parts. The jaw bones also offer a resistance to infection found nowhere else.

In a series of articles on "Contributions to the Surgery of Bones,"[1] the late

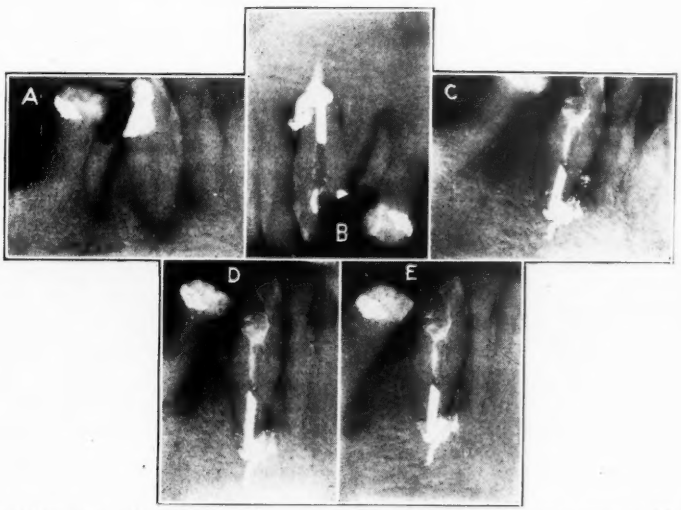



Fig. 8 (Case 15).—*A*, ugly area of many years standing about a lower cuspid. There is a retained root adjoining. This was extracted. There is simultaneous healing of the bone in this socket and on the distal surface of the cuspid. This regeneration is seen proceeding gradually in *C*, *D* and *E*. The dark space on the labiomesial surface is a deep pyorrhea pocket. The gum at this point is now tight, pink and healthy looking. *B*, pyorrhea pocket with surplus material forced into it. The pocket was so deep (extending to the end of the root) that the root-canal filling passed from the canal out into the pocket, as shown in *B*. *C*, pocket with some of the surplus material removed with an instrument. The gum over this pocket is very firm. Stillman and McCall, in "Clinical Periodontia," say, "The field of the root canal operator is distinctly the exclusion of infection from the apical tissues of previously healthy teeth." An attempt has been made to observe the directions of Stillman and McCall, who advise treatment only of cases in people comparatively young. This "young lad" was only 79.

such metals as zinc, copper, aluminum and steel show the effect of the presence of micro-organisms and of oxidation in

John B. Murphy, surgeon, of Chicago, says: "The implantation of foreign ma-

1. Murphy, J. B.: J.A.M.A., 1912.

terial is confined to a few situations in the body, and only a few materials can be used. The field must be absolutely sterile, and where osteogenesis elements are present, magnesium plates, tubes, or columns can be used to advantage. This metal eventually is absorbed. In positions where it is impossible to secure a primary sterile field, as in operations on the mandible, non-absorbable material may be used, especially in the face, where the circulation is so rich and tissue resistance so great that the infection is overcome and the foreign material becomes encapsulated without a sinus forming subsequently. After the removal of portions of the jaw, an open cantilever silver wire support may be used, and it becomes encapsulated." (Here the illustration of a patient, Miss S., is shown, with one-half of the mandible, including the head, all replaced with silver.)

"Suppuration occurred around the framework as it connected with the mouth, and a profuse discharge was present for six weeks, and then ceased entirely. The sinus healed and the framework became entirely embedded. In a report received three years after the operation, the patient's physician says that there is no sinus either in the mouth or in the cheek. This implanted framework is not so likely to heal without fistula formation in less vascular and less resisting tissue of the body. The mouth and face offer the best field for its use."

Metallic mercury in mass has no action on the body. A pound of mercury taken at one dose produces absolutely no physiologic effect. The only effect it has in the stomach is purely mechanical. It is as insoluble as would be a lump of gold or silver. If it could be injurious in contact with the tissues, nowhere would it be more so than in the millions of mixes in the hand that have been made by dentists since the beginning of the use of amalgam for the filling of teeth.

We are all so familiar with the effects of mercurous and mercuric compounds that it is hard to disassociate them from pure metallic mercury. It is to be remembered as well that vaporized mercury in the air is as different from metallic mercury in mass as are the salts. So also is metallic mercury in suspension in finely divided particles for intravenous injection.

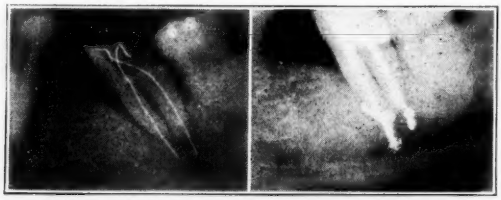


Fig. 9 (Case 19).—Left: Lower second permanent molar with diagnostic wires with marked area about the entire surface of all the roots. Right: Three canals filled. There is regeneration about every surface of the roots from far below the apex up to the alveolar border.

Experiments with various metals to demonstrate their effect for suture or internal fixation of bony parts have long been followed, and different degrees of tolerance and intolerance are fully recognized. There have been various theories as to this tolerance or intolerance. It is, as Rugh says, "an extremely complex subject by reason of the ever changing biochemical problems in the tissues and

the variation in the atomic weights, solubility, basic combinations with various chemicals, electrical reactions, oxygen combining properties and other such factors on the part of the metals."

Metals readily oxidized by body fluids may set up irritation and aseptic suppuration in the tissues. Such metals as iron, steel, copper, zinc and nickel come under this heading. On the other hand, tin, gold, and silver do not oxidize in the body fluids and are well tolerated in the system even in their hard, compact form. For instance, steel is used for the support of bones, but is liable to act very unfavorably when used alone. If coated with tin so that only the tin is exposed to body fluids, it is admirably tolerated.

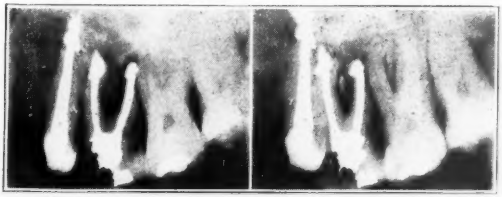


Fig. 10 (Case 20).—Bicuspid and molar which had long been putrescent. The molar was hopelessly pyorrheic and was filled as an experiment only. The palatine root was excised and the buccal roots were filled as shown. This tooth has tightened up and the gum was much improved without any further treatment. The bicuspid responded perfectly. The case was syphilitic.

Metal mercury, being absolutely without mechanical irritation, is probably more perfectly tolerated in the tissues than any other substance. It is not subject to oxidation nor is any irritation apparent in the slightest degree; and so it would seem that by combining mercury, tin and gold in a plastic form that adapts itself without pressure or resistance to the most delicate impression, an ideal material would be had for introduction into the human tissues. It seems ideal for use in a root canal because of its plasticity, its nonirritating qualities and its ability to exclude liquids from any cavity in which it is placed. It has been subjected to the most exacting tests to prove that it will not leak in a root canal. Tests made with glass tubes of various sizes filled with this material have proved that it is absolutely nonleakable even when placed under the pressure of a column of water for months at a time. When simply placed against the inside of a drinking glass and this glass filled with dye, it will not leak. The bright surface of the metal can be seen through the glass with absolutely no trace of leakage even after immersion for months. One can readily understand then that it will absolutely exclude liquid from a root canal when it is surrounded by walls resisting at every point instead of being simply placed against one wall as it is in the glass.

Grieves (of blessed memory) stated, in his discouragement, "It is by other than the dentists' process that the pulpless tooth problem must be solved." This was said in all sincerity, but he was wrong. Since when, may I ask, has the dentist lost the ability to work out the problems of the organs on which he constantly operates?

While looking for a filling that would meet the requirements, I chanced to

think of trying (by the "dentists' process") the mixture of tin and mercury that I had long been familiar with. Finding that this set too much and did not remain sufficiently plastic to be used without irritating qualities, I thought of adding gold to the mixture — another "dentists' process" with which I had always been familiar. It was after this (often when actually using it in practice) that I began to hunt for justification. This I found in surgical literature, not in dental. Furthermore, it was in surgical literature that I found the bone operations and treatment which led me to my treatment of tissues about pulpless teeth.

The mixture that I am now using is

Fig. 11 (Case 23).—Upper molar (extensive pyorrhea) filled as an experiment. It responded perfectly. One root was amputated.

two parts gold to one part tin. In mixing the gold and tin (usually tin foil and gold foil—being sure of a pure quality of each), I found the results peculiar. Mixes of the same kind seem at times to act differently. For instance, at one time, I mixed gold and tin, equal parts. The next day, this was very slightly set, not so plastic as I would like. I then made a mixture of two parts of gold to one of tin. Leaving this for twenty-four hours, I found a very soft, plastic mix. Then I made a mix of two parts of tin to one of gold, and I found this also a soft, plastic mass. Again, sometimes the mixes will set slightly in a few hours, and then after several days become more yielding and plastic. In fact, the mixtures behave so differently under seemingly the same circumstances that constant surprise is experienced. Again, different makes of gold and tin differ in their action. Some of these act differently, if cohesive or soft foil is used.

This is a very complex thing and much experiment will be necessary to get the best and most uniform result. I am making extended tests of this material in many ways to work out this problem. I suggest that the filling material be used in small glass tubes. You can see just how it is working by watching through the glass. The finger may be held lightly against the end or a rubber cap may be stretched over or any other means employed to simulate the resistance the apical tissues would offer.

The plugger should be considerably smaller than the canal. You will then find that the material which goes through the foramen is very plastic, while that in the canal becomes somewhat firm by the mercury being expressed toward the coronal end. Considerable experimenting should be done with glass tubes of different sizes and on extracted teeth before the material is used in the mouth.

This will surely repay the effort, and besides it is quite fascinating to thus experiment with it. One will see by this means how definitely, perfectly and easily the apical foramen is filled, and so that it will not leak.

These tubes can be immersed in methylene blue, or other dye, to test for leakage. It is remarkable how easily and quickly these tubes can be filled and made to resist any kind of a test for leakage. Please bear in mind that this should always be done definitely and accurately.

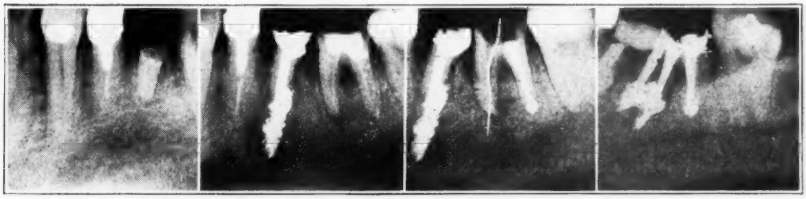
I believe this material can be more accurately controlled than any other that has ever been used, even if the operator desires to carry it only as nearly "just to the end" of the root as he possibly can. That is to say, if the operator desires to carry the filling as nearly as possible just to the end of the root (or to any desired point), it can be more definitely placed than any other material that I know of, and come nearer to sealing the foramen when so placed. My own preference is to carry it beyond, as the material in the apical space remains permanently plastic and seems to be absolutely nonirritating, to be perfectly tolerated by the tissues and to encourage tissue regeneration. In addition, it is impermeable to the fluids of the body.

In a tube, constricted at the neck or even when funnel shaped, when filled from the small end (the finger or any suitable thing held over the top), the material readily fills the entire capacity. These tubes when submerged in dye show no sign of leakage. That, it seems to me, is a severe test of leakage and shows how the filling will flow over the denuded end of a root and protect the apical tissues from this root.

1. If some part of the root end is denuded (after the foramen is enlarged), the filling has access and room to cover and stick, as on the side of the glass (Fig. 1) without leakage. Any small canals in this area will be covered.

2. If tissue does not wedge and grow in over the denuded cementum, the filling remains and covers without leakage. Moreover, the tissue above presses it down from every direction more tightly against the denuded surface.

I ask you to mold some of this filling material over the end of a glass tube or



A B C D

Fig. 12.—Bicuspid and molar, both known to be pulpless for at least ten years. *B*, great extension of filling below apex of bicuspid. This tooth suppurated for several weeks. The large cavity in this bone can be accounted for only on the ground that the infected bone sloughed to this extent during suppuration. Certainly, the instruments could not have reached where the filling does. The filling was done as soon as suppuration ceased (about two years ago). It is believed that in two or three months much bone would have filled in and the filling would have been much smaller. The same applies to the filling material in the bone about the mesial roots of the molar as seen in *D*. The bone evidently had a low-grade inflammation for years and in suppurating the diseased tissue evidently sloughed out to the extent indicated by the filling. Dr. James F. Brailsford of Birmingham, England (Am. Dent. Surg., August, 1928) says, "It must be clearly understood that the evidence which the radiograph gives is only a 'skeleton' picture of the pathological lesion. The actual lesion, certainly in bone pathology, is always of much greater extent than the radiograph suggestions to an untrained observer." It is to be remembered, even around these cases, where there is such an overflow of material in the bone, that there is no enlargement of the gum or bone at the apex.

a root of an extracted tooth (after filling the canal), and subject it to any fair test you like in liquid. You will find there is no leak between the material and the root. To put it in other words: If the tissue displaces the material, it grows in and covers the spot, where it displaces the material. If it does *not* displace the material, the tissues above and on the sides press against the material and press it more firmly down against the denuded root end, and prevent leakage, thus shutting off the infected root end from the apical tissues.

It is to be noted also that if the infected tooth end is so walled off, it soon will no longer be infected for the microorganisms will die in their own products and the apex become sterile. As Fish, of London, has shown, these denuded root ends sometimes are entirely sterile anyway.

Of course, as seen elsewhere, I recommend removing the denuded cementum by the use of the bur. (Fig. 6.)

We have to remember that the part of the filling material that goes through the foramen is softer than that which remains in the canal and gives way to the slightest pressure from the encroachment of the healing tissue.

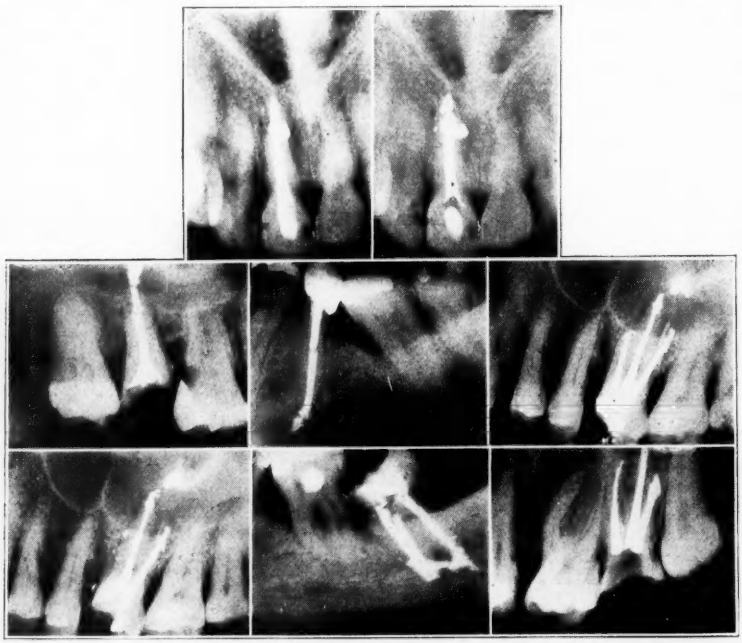


Fig. 13.—Miscellaneous cases, showing results in the average case.

If we refer to an illustration by Hatton[2], we will note how perfectly the denuded area would disappear by enlarging the canal. This would entirely

2. Hatton, E. H.: Regeneration of the Apical Region After Treatment and Filling of Pulp Canals, J.A.D.A., 13:486 (April) 1926.

remove this area without even making the end funnel shaped. It would also remove any multiple foramina opening into this space, and even if all the denuded surface were not removed, the filling would cover it up (together with any accessory foramina in that space) and wall it off from the apical tissues.

I believe this answers the last reasonable objection to the treatment, filling and retention of the pulpless tooth.

I am compelled to finish abruptly. The difficulty has not been to write, but to condense. I have been able to put into this short paper little, certainly very little, of what I have written, and I fear that it is quite disconnected and rambling.

I know well the questions that suggest themselves, and quite naturally:

1. Is the large opening of the apical foramen good surgery?
2. Does the bone actually drain through this large opening?
3. Can any material be tolerated by the tissues?
4. Can healing and regeneration take place in the presence of this material?
5. Will mercury cause poisoning of the tissues?
6. Can a large foramen be really sealed and the case made a success?
7. Even though the operation is apparently successful, will the tissues remain healthy?

I admit that the method is still on trial, that it requires the test of time. I admit that we have to see whether the presence of the foreign body will cause degeneration, but of this there has been no sign thus far. The method has been fairly tested, and has not been found wanting. It is the first drainage of the wound, as in other surgical wounds, that has been done; the filling is tolerated as no other has been, and no other method of sterilizing and cleaning the tissues has been carried out in the way this has. This is more in accordance with surgical principles. And, last, no other method has (in this very impartial and indiscriminate way) given the uniform clinical results.

The record is as follows: All the cases that have remained in my hands are successes; at least, the clinical symptoms so indicate, and I can never believe that good clinical symptoms constantly follow and persist in the presence of disease.

I am not unaware of the storm this will precipitate, nor the antagonism it will cause. It has required no small degree of temerity to proceed with this work. It was contrary to all teaching; that is, all dental teaching.

If this paper has given the impression of assurance or overconfidence, let me hasten to say that it is with fear and trembling and with the utmost humility that I submit this procedure for general trial. I feel that it should have much, very much, to do with finally changing our attitude toward the pulpless tooth. But the way will be long and tedious, and men generally may not take to it kindly.

Sir Isaac Newton said, "I keep the subject continually before me until the first dawnings open little by little into a full and clear light." It is in this spirit that I have tried to carry on this work, and it is in this spirit that the profession must henceforth regard this problem if the pulpless tooth is not to be lost to dentistry.

# PERIODONTIA AND ITS OBLIGATIONS FROM THE POINT OF VIEW OF THE GENERAL PRACTITIONER*

By WILLIAM DWIGHT TRACY, D.D.S., F.A.C.D., New York City

EVERY busy dentist who is conducting his pratice along truly professional lines carries heavy responsibilities and assumes very definite obligations. We realize that the day when the placement of a filling, the extraction of a tooth, the insertion of a bridge or the mere relief of pain was regarded as a complete service has long since passed and that it is the duty of the dentist of today not only to safeguard the integrity of the organs of mastication and their contiguous parts, but, indirectly, also to protect the general health of the patient.

To the careful observer, symptoms of many disturbances of a systemic nature may be noted in the oral cavity before serious inroads have been made on the health and vitality of the patient, and it is the duty of the dentist to be awake to this possibility and, by keen observation, to recognize these departures from the normal and take proper cognizance of them. Symptoms of this sort, if recognized by the dentist in their incipiency and called to the attention of the patient with a few words of explanation and the recommendation that the advice of a physician be obtained, may frequently avert serious complications and prove to be an invaluable service to the patient.

Among the varied obligations carried by the general practitioner, there is perhaps no obligation more constant, more real or more important than the early recognition of these departures from the normal which may be classified under the general heading of periodontal disease. It is unlikely that any practitioner who has seen the devastating results of neglect in this connection will desire to differ with this statement. Periodic examination of the teeth for caries, or for defects that may induce caries, may be systematically carried out with the aid of the roentgen ray, and every operative procedure essential for the control and prevention of caries may be conscientiously performed. But if the health of the investing and overlying tissues is neglected, all this work, however fine, may go for naught.

It is extremely desirable that students of dentistry be systematically taught to cultivate their powers of observation. It is essential that their attention be definitely called, as frequently as possible, to the beatiful picture presented by normality of the gingiva and the other soft tissues of the mouth. Only through a thorough knowledge of what normality really is and with the picture of perfect tissues firmly fixed in our minds are we able to detect the evidences of disease in its early stages. It has sometimes seemed to me that some of our practitioners, even those of mature experience, have become

*Read before the Section on Periodontia at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

so accustomed to looking at the picture of gingivitis in its varying degrees of advancement that they have forgotten what normal healthy gum tissue really looks like and accept the gingivitis as a matter of course. As a matter of fact, it is one of the most prevalent and convincing symptoms that come under our observation, and there is always a reason for it. It is, therefore, the obligation of the general practitioner to find out the reason, and to administer the necessary and proper treatment looking toward a restoration of the tissues to their normal state. Under the direction of the dentist and with a reasonable degree of interested and intelligent cooperation on the part of the patient, the large majority of cases of simple gingivitis can be definitely reduced and controlled.

If the dentist finds that, in spite of his best efforts, he is failing to restore and control the health of the tissues, he should recognize it as his duty to refer the patient to a competent and experienced periodontist, if one is available. Many progressive dentists who are situated in small cities and towns where no specialists in this line of work are available have so keenly felt their responsibility in connection with this part of their work that they have made the necessary sacrifice of time and money to go away from home and take a postgraduate course in periodontia. This evidence of the fact that these men have an innate feeling of professional responsibility toward their patients is most commendable. In the larger cities, many general practitioners are glad to refer their patients to specialists for periodontic treatment, or a periodontist may be included as one of the associates where a group practice is conducted.

As intimated in the foregoing paragraphs, the real responsibility of the general practitioner is to see that this phase of his patient's dental welfare is not neglected, that the patient not only receives proper treatment, but also receives adequate instruction in the careful and intelligent personal care of the teeth and oral tissues. This is just the beginning of his responsibility, and his obligations to the patient in connection with the prevention of periodontal disease are omnipresent while he pursues the daily routine of his practice.

Normal gum tissue is quite resistant to occasional undue stress and recovers readily from slight injuries under ordinary circumstances, but when irritation of any sort is persistent, the tissue invariably resents it, and this resentment is expressed in terms of congestion and hypertrophy, or of atrophy. The ultimate expression of neglected congestion of the gingival tissue is very liable to be the formation of a so-called pyorrhea pocket, with concomitant breaking down of the peridental membrane, loss of support and the possibility of the loss of the tooth.

For these reasons, it behooves the dentist to so manage and finish his restorative work on any individual tooth that, when it is completed, the filling, inlay or restoration of whatever nature, not only seals the cavity with a view to preventing further caries, but does so in such a manner also that its proximal contour will be restored and no roughness or irritating influence will be present to damage the gum. I am not convinced that occlusal trauma is responsible for the numerous and varied ailments that are ascribed to it by some writers, but it is an important factor and one that must receive studious attention in all types of restorative work. Neglect of this detail may cause permanent injury to the investing tissues of the individual tooth. It

is also essential that the status of the occlusal balance of the entire denture be submitted to a periodic check-up in order that undue stress may be relieved before serious damage occurs, the operator bearing in mind the fact that abnormal strain on any tooth, when long continued, causes structural changes of a serious nature in the peridental membrane.

When the responsibility for the complete care of a patient's mouth is divided between general practitioner and periodontist, the latter may have just cause for dissatisfaction and complaint if he finds that the dentist is lacking in skill and understanding or that he is not impressed with his obligation to carry out his part of the work on a scientific basis. The failure of the dentist to restore proximal contact on an inlay or a filling, thus permitting the impaction of fibrous food material upon the gingival tissues, may defeat every effort of the periodontist to establish a condition of health in that area. Or his failure in leaving a rough overhanging edge at or underneath the margin of the gingival tissues may have the same unpleasant result. The factors that enter into the proper treatment of the teeth by the general practitioner and the factors that may cause failures are too numerous to mention, and the same is true, of course, of those who are practicing as specialists. But the items just mentioned will serve to illustrate how the failure of one may interfere with the success of the treatment being administered by the other.

When periodontia flowered into a specialty of dental practice, it assumed many obligations and faced many problems, some of which are quite abstruse, and some of which are still perplexing. Speaking for the general practitioners, it seems quite safe to say that they feel that periodontia has met and has fulfilled its obligations. Those who are working in this special field have continuously studied their problems, and marked advances in the science of diagnosis and in the art of treatment have been made. A study of the mechanical factors involved in the cause of periodontal disease covers only a small part of the general problem; and, to the periodontists, we are much indebted for scrutiny of the concomitant biologic and physiologic phases of the study. Their contributions in this connection have been material and important.

Quoting again the circumstance in which the responsibility for the complete care of a patient's mouth and teeth is divided between general practitioner and periodontist: It seems reasonable to expect that the specialist should assume the entire obligation of educating the patient in the matter of the proper care of the mouth and teeth. It is within his sphere of activity to give the patient all available information that will be helpful in obtaining and maintaining the maximum degree of dental and oral health. It is his function to prescribe the method of cleaning the teeth and stimulating the soft tissues, and he should suggest the type of brush, silk floss and dentifrice to be used, and give full and complete instruction in regard to their use.

We expect that he will assume the obligation of arranging a schedule of periodic visits for the patients according to their needs and that he will be in full control of the situation as far as the periodontic requirements of the case are concerned. We feel that, during the course of his treatment, he is in a position to note the early evidences of caries on unfilled surfaces and that he will discover defects in work that has already been done on the teeth. A chart noting all

such items should be made and sent to the dentist who is sharing the responsibility with him.

As regards the early discovery of incipient caries, there seems to be some difference of opinion as to just where the responsibility should lie. The periodontist should assume the obligation of making a searching examination for caries or other defects at each periodical visit of the patient, and the general practitioner should make a set of bite-wing films, at least twice a year, for youthful patients and at least once a year for adults. Roentgen ray studies of this type are of great assistance in locating obscure caries on the proximal surfaces, and not infrequently cavities are disclosed which escaped attention during a careful search with the finest explorers in the hand of a competent operator. When this plan is systematically carried out, the tragedy of pulp involvement through deep seated caries rarely occurs, and as a matter of fact should never occur.

It is assumed that the periodontist, like the dentist, is interested in maintaining the complete health of the entire masticating mechanism and oral cavity, and in preventing any untoward development that might permit the inception of disease. Why, then, should he not be interested in examining the teeth for caries as well as examining the supporting structures for departures from the normal? It is the custom for most general practitioners to see their patients at least twice a year for personal examination, and they are thus in a position to share the responsibility of preventing extensive caries. Most dentists will agree that when all of us do all that we can to safeguard the integrity of the teeth, there are yet so many cases in which it is a running fight to keep pace with the ravages of caries and other dental diseases that seem to beset certain patients.

In the matter of prevention, perhaps none of us have such an important position as the periodontist because his work is, in a sense, fundamental. It is his task to keep the teeth well supported in their sockets, and when they cease to be so supported and fail to function because of disease in the surrounding structures, all the fine inlays and artistic porcelain crowns are of no avail.

In a dental practice of several years' standing, there are always two classes of patients; namely, those who may be classed as old patients, having been among the clientele for several years, and those who may be spoken of as new patients, having been on the list for only a few months or a year. In the case of the old patients, we hope to find satisfaction in what has been accomplished, but, with the newer ones, we find fresh problems. When the new patient with a well developed case of pyorrhea comes into the office of a general practitioner who has eliminated periodontia from his routine, that dentist is glad to refer the newcomer to a periodontist. With a complete set of roentgenograms and study models in hand, and after a careful examination and vitality test, the dentist is in a position to make a diagnosis and recommend a procedure.

The patient is referred to the periodontist for examination, consultation and treatment, and if the dentist has failed to check for extraction a tooth (or teeth) which the periodontist in his mature judgment feels is hopeless as far as treatment is concerned, it is his obligation, in the interest of the patient, to say so and to state his reasons that it should be removed. His reasons may be based purely upon local conditions, or they may be based upon those conditions plus certain

factors in the general physical condition of the patient. In any event, on his advice, the patient is spared the necessity of submitting to a course of treatment in an attempt to retain a tooth the successful treatment of which is doomed at the outset.

This hypothetical case is quoted to show that, in the present day of specialization, responsibility must be shared, and we must realize that only through wholehearted cooperation on the part of those who are in charge of the patient will the best service be rendered and the patient's best interests be safeguarded.

The last analysis would seem to indicate that the obligations of periodontia are no different from or no more burdensome than those of the general practitioner or those of other specialists engaged in the broad field of dentistry. We are all working, primarily, for the prevention of dental disease and for its cure when it has occurred, and for the ultimate benefit of humanity.

DISCUSSION

*Edward B. Spalding, Birmingham, Mich.:* Dr. Tracy has said: "The day when the placement of a filling, the extraction of a tooth, the insertion of a bridge or the relief of pain was regarded as a complete service has long passed." When that day passes in any professional man's life, he is a truly professional man. But when cases of advanced stages of periodontoclasia come under our observation and these patients have been in the hands of general practitioners who have more or less taken care of their mechanical needs, and yet the periodontoclasia has either not been noted nor has its need for treatment been mentioned, I wonder if possibly that day has not passed for many in our profession. A dentist in conversation with a physician said, "Doctor, I sometimes make the remark that not more than 50 per cent of professional men are truly professional." The physician hesitated a minute, and said, "You have it too high—not more than 25." Now if a physician feels that way about the old profession of medicine, we should feel very hopeful about dentistry, because the percentage is certainly higher than that in our profession. But the general practitioner undoubtedly is getting from under a great deal of his repsonsibility in not diagnosing and treating cases of periodontoclasia or referring them to specialists. We agree with Dr. Tracy that no obligation of the general practitioner is more constant, more real or more important than the early recognition of those departures from the normal which may be classified under periodontal disease, but these departures from the normal are not always easily recognized by the untrained eye. The least departures from the normal are the most difficult to recognize. In advanced cases, we cannot help but recognize them. The beginning of periodontoclasia is easy to treat, and the general practitioner can usually bring about a restoration to normal, but as a case becomes advanced in form, so does the skill of the operator have to be greater, and the result is less certain. J. D. Towner says that more teeth are lost from periodontal disease than from all other conditions combined. Dr. Towner has had many years of experience as a periodontist, and is well qualified to estimate the number of teeth that are lost from periodontal disease. When we consider this statement, we realize the great responsibility which rests on the general practitioner. Dr. Tracy says that students of dentistry should be taught to cultivate their powers of observation concerning the health of the gingiva. Students may learn in college to observe these things, but if they do not put their training into practice after they are graduated; if they do not carry out simple cases themselves, they will soon forget what the normal, healthy gingiva looks like. Every general practitioner ought at all times to be carrying out one or two simple cases in order to keep his observation keen, even though he may have a periodontist associated with him. Dr. Tracy has put most of the responsibility and obligation on the general practitioner. He and the periodontist can each help the other, but the periodontist can more often assist the general practitioner in suggesting what should be done toward the health of the mouth in reconstruction than can the general practitioner assist the periodontist. Periodontia is necessarily the foundation of all dentistry; we therefore cannot ignore it.

*A. H. Merritt, New York City:* There is one point which Dr. Tracy, as a general practitioner, has made which I think should be emphasized to a group of periodontists; that is, the importance of more thorough examinations. I believe there is no one in a better position to make a complete and thorough examination than is the periodontist in his treatment and care of the mouth. This he should do in a way that will be at once thorough and comprehensive. There is one other factor to which Dr. Tracy has called attention and that is the preventive aspect of periodontia in its relation to general practice. This cannot be overemphasized. Periodontia should have for its object the prevention, as far as this is possible, of all dental diseases, and Dr. Tracy, as a general practitioner, is quite right in calling our attention to it in the forceful way in which he has done so.

# EMPIRICISM IN DENTISTRY*

By NORMAN B. NESBETT, D.M.D., Boston, Mass.

FROM time to time, we are confronted in our dental literature with articles deploring the vast differences in teaching methods used by our leading teachers and clinicians. One such article, dealing with the difference in methods used in partial denture prosthesis[1] has recently appeared in one of our current dental magazines.

Along with other interesting and constructive observations, the author states, "In other sciences, before a new thing is accepted, a dozen or dozens of men repeat it to test its value. Why not adopt the same method in our field? Anything, before it is brought out publicly, should be tested by a group of men organized for this purpose, and it should be publicly shown or demonstrated only after these groups or committees, by eliminating all useless, complicated or intricate details arrive at a result." In other words, the author of the article quoted deplores the teaching methods that are founded too much on empiricism. What *is* empiricism? To many of us the word "empiricism" may be one of those dry-as-dust terms that are usually dubbed "highbrow," and passed by without further thought. It may be reminiscent of the earlier struggles of scientific medicine for proper recognition, and to most of us it is an epithet rather than a mere descriptive term: an epithet the objects of which do not concern the dentist very greatly. Yet the word is full of vital significance for us. It describes much that passes for dental science, even in this year 1929. It should be to us a danger sign, pointing to the proper approach leading to sounder methods of diagnosis so as to found dental diagnosis on more scientific methods of observation. The familiar dictionary definition of empiricism as applied to medicine, the scientific connotation, of course, which interests us, is "a practice of medicine founded on mere experience without the aid of science, or a knowledge of principles; hence, ignorant and unscientific practice, charlatanry, quackery."

*Read before the Section on Partial Denture Prosthesis at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

1. Osla, Victor: Dent. Cosmos, 71:323 (March) 1929.

I say that this definition interests us, because dentistry is a branch of the art of healing, and because much of what passes as dental science is just empiricism and no more. I say this deliberately, without attempting to impugn the professional honor of those who are dental empirics without being aware of the fact. I say it seriously in spite of the tremendous progress that has been made in the field of dental research, and of dental education. I repeat it because, notwithstanding this progress, the peculiar conditions under which dental observations are made have not been clearly recognized.

While in other sciences much attention has been given to the manner in which scientific evidence is obtained, to the nature of the experiment, to the use of hypotheses and to the control of the subject of experiment, I am not aware that their own problem has been greatly studied by dental thinkers. One does not have to travel far to find that, at the present time, most of our teaching and practice in the field of partial denture prosthesis has been based on just such empiric knowledge—knowledge handed down from teacher to successor-teacher, without the test of scientific group research applied to it.

Is it any wonder, then, that the average dentist senses a lack of training in this particular field, and a good clinic on this subject will draw a larger body of observers than a clinic on any other subject. Surely it is not idle curiosity that prompts these men to crowd around the clinicians' table, or the exhibition spaces of the commercial exhibits and clinics on this subject. Talk with them and they will tell you that they are after information, that they are not satisfied with their present knowledge of the subject, and do not feel able to cope with the problems their patients present. Let us, if we can, try to find out what constitutes their difficulties.

The science of partial denture prosthesis is, and always has been, as I have already observed, a much neglected branch in our dental curriculums. Either the crown and bridge department, all too busy with their own problems, attempted to handle it in a half hearted manner, or it was sort of a stepchild of the full denture department, where the undercurrent conviction was held that it was unwise to waste too much time teaching it as the patients would be candidates for full dentures in a short time.

I am stating this with a full knowledge of the value of the efforts of a few of our grand old teachers in prosthetics, and with no attempt at belittling their honest efforts. But these teachers were few, and they were usually so wrapped up in departmental red tape that they usually either retired early in the struggle, or else died sadder but wiser men. At no time can we find that they were successful in organizing group research and observation on this subject.

To understand fully how unsubstantial are some of the foundations of dental science, let us consider for a moment what it is that lends exactitude to scientific research. The first thing is the use of rigorous methods of observation and record. The next is control of the subject. These two things enable every other scientist to prove or disprove the conclusions of any other investigator. By definition of the hypothesis applied, by minute records of the conditions of the experiment, and of what occurs before it is over, every other investigator is able to stage for himself the scientific drama, to project the same causes, to recognize the alleged effects, to measure their partial or total absence, to separate the constants from the variables and to confirm

the truth by supplementary observation. The reaction of a chemical compound in the presence of another chemical compound, the response of the organs of a living being to micro-organisms, the effect of the stresses on the structure of a material, may be observed by one scientist on the Continent of America, and confirmed or disproved by a scientist in Japan.

Through clear definition of terms, through minute records of experimental technic and methods of observation, the objective reality discovered by one human being in one part of the world can become known to any other human being in any other part of the world who is equipped for observation and trained to make it.

Where control is partly or wholly lacking, where to keep a record is difficult if not impossible, the progress of science is slow and uncertain. At the other end of the scale of human knowledge, for example, from that of physical or chemical science, is the science which investigates what we term the mind, the science, so-called, of psychology. As far as it is possible to observe, record and even control the movements of the parts of the body, or even changes or disturbances of muscular and nervous tissues, or the flow of the blood, exact observation is possible. Yet, the stages of consciousness, the sensations or emotions that accompany or cause, or are caused by, occurrences in the human body, are difficult to observe, and even more difficult to record.

We all know how deceptive all introspection is. We all know how different the dream really was from the story of the dream we repeat after it has passed. We all know how uncertain the exact feelings of a moment ago become. The apparent impossibility of holding states of consciousness for examination and record makes the progress of psychologic science a slow matter, unless this science is to be defined wholly in terms of physiology of behavior, the responses to internal or external stimuli of a living organism.

Between these two extremes of the scale of science lie medical and dental science, with the advantage in favor of medical science. The sick patient places himself in the control of the doctor. He goes to the hospital, or, if he remains at home, his movements are at the command of his physician and his nurses. Diet, the frequency and nature of nourishment can be controlled, as well as bodily reaction to therapeutic agents. Complex though the human organs may be, difficult though control generally is, the helplessness and the fear of the patient *do* make him a controlled subject of experiment for the physician, at least while the illness lasts. This is all quite aside, of course, from the situation which arises at death, which makes possible a necropsy.

It is unnecessary for me to dwell on the more obvious types of control of the experimental field that are within the power of the medical research man, such as the observations of histologist and bacteriologist, or experiments on living animals. It is largely beside the point, because I particularly wish to stress patient control, the factor of special interest to the dentist. Histologic research, of course, bacteriology and experiments on living animals have helped the progress of knowledge of conditions that affect the health of the teeth.

These branches of dental research are of great importance, and too great praise cannot be bestowed on those who have labored arduously in these fields. We can only pray for the men and means to be multiplied to continue this special work. Still, over a large part of the field of dentistry, and particularly prosthetic dentistry, these studies can help us

only to a limited degree. To clear the way of so many of the abject fallacies that beset the prosthetist, as well as the charlatanry that beguiles so many of us, some method of research through more perfect patient control must be devised.

It is with the actual case that we must deal; with case histories of living patients, who do not go to hospitals, who do not place themselves bodily in our charge; who leave us and return months or years afterwards—if they do not go to other dentists—with their mouths wrecked, as the result of superficial observation, superficial diagnosis and case planning, "without the aid of science, or a knowledge of principles."

It is not merely in the matter of control that the modern physician has the advantage over us. He is able to employ, and he does constantly employ, a system of records, a method of observation; in other words he knows the phenomena for which he must be on the lookout, and he has these phenomena tabulated. In the matter of temperature, blood pressure, pulse rate, condition of the urine and examination of tissue or blood specimens, even in the conduct of an operation, systematic records are employed.

These things are so familiar to all of us that we may forget to contrast the procedure of the physician with that of the dentist in his office. Yet, if we do stop to make this comparison, many of us may be a little appalled, and may wonder how dental science can ever hope to make progress, if the clinical observations of the average dental practitioner are to have the same weight as those of the ordinary medical practitioner. Yet the clinical observations of the average dental practitioner are introduced into dental science, as they should be.

Without entering at this point into a discussion of the precise relation between the every-day clinical observations of the average dental practitioner and the proposed work of the dental research worker, I do wish to emphasize the necessity of patient control, and of the use of systematic methods of recording. I propose to support my contention by dwelling on some familiar examples of empiricism, and then to show how this state of affairs may be remedied.

Let us begin with the simple issue of the destruction of the enamel of teeth in contact with clasps. I select this because the problem is a comparatively simple one. We will eliminate from consideration the factor of the possibility of torque, when tissue support is also involved. We will not take into consideration the possible effect of a rigid, or semirigid anchorage on the normal functional movement of teeth. These effects may occur with or without the accompaniment of enamel decalcification, and this is the point that we will consider in relation to the manner in which dental observations are commonly made.

Three views of this phenomenon commonly prevail. One that the destruction results from abrasion or wear of enamel by clasp metal; the second, that it is due to the biochemical effects of the acid products of fermentation retained between the clasps and the enamel, and the third, that it may be due to one or the other of these causes or both. While I have in the past been associated by the profession with the cast clasp, although I have never advocated its general use for partial dentures supported upon the mucosa, it happens that I have abandoned its use very largely, if not entirely, even for appliances supported entirely through the roots of anchor teeth. I do not propose to discuss the issue itself, but to point to the wholly empiric manner in which it has been settled in the minds of

most of us. It is preposterous, of course, to say "it does not matter whether the cause is abrasion, or corrosions, or both —the fact is enough for me." It is preposterous to say this, not because such a statement would hardly be made seriously upon a platform, however often it might be reiterated between one of us and others, but because the answer to the question is not academic. Whether the damage is due to abrasion or to corrosion, or to both, and if so, under what conditions, is a question of great practical importance.

The answer must necessarily determine the type of clasp to be used, when clasps are indicated. If the effect is due to corrosion, our main object in this connection must be to limit the area of contact between the arms of clasps and the enamel of teeth, even perhaps at the expense of stability. If it is due to abrasion, we must use rigid, or semirigid clasps, whenever this is feasible, a circumstance that must have an obvious and an important effect on partial denture procedure.

Yet, where are the data upon which we can found our decision other than the individual observations of each individual practitioner? If the settlement of this issue were intrusted to research conducted in the manner in which scientists approach problems in physics or chemistry or in which our medical brethren deal with pathology, test cases by the thousand would have been observed, with as nearly perfect control, and as definite and comprehensive methods of record as are feasible. Where are such records? Where are data to be found on the acidity, if there is acidity, of the saliva between the surface of a clasp and the enamel? What data have we on the capillarity of saliva, which is an important factor in the hypothesis of corrosion? What data have we on the porosity of casting gold, and the relation between porosity and the retention of saliva in voids? Some speak glibly of the virtue of polishing the inner surface of cast clasps. All of us believe this to be helpful in preventing corrosion, yet what data have we on the extent to which polishing the surface of cast gold may expose or eliminate voids?

Again, on the possibility of abrasion, what do we really know of the possibility of abrasion of the enamel of teeth in the mouth? To what extent are abrasives present in the saliva itself, or in finely macerated food particles that may be held in suspension in saliva? We have heard of an experiment being conducted in which a cast wheel of hard casting gold was rotated for twenty-four hours against the surface of an extracted tooth. Can an experiment of that kind be regarded as conclusive? Can it be regarded as a scientific observation?

Or let us take the matter of what has been termed "physiologic basing" for lower partial dentures supported upon the mucosa. This technic is not generally practiced, but on what grounds has it been thrust aside as unnecessary or superfluous? What data are there to support the common contention, so often repeated, that resorption takes place under any partial denture inevitably? What properly recorded evidence exists beyond the fortuitous concurrence of individual opinions? Why should each proposition be generally accepted in the absence of definite records of treatment, case design and mouth conditions, as well as postconstruction case histories?

Consider the cast assemblage of partial dentures to which the loose term "casting in one piece" is applied with the characteristic looseness of empiric modes

of thought. What records have ever been produced that would merit the respect and not the contempt of a scientific man to show that dimensional changes in the casting do not result in torque and traumatic lateral thrust on the anchor teeth, or aid in the resorption of the alveolar process, by overloading small areas of the mucosa?

Every man who has surveyed dental practice beyond the narrow limits of a particular locality must recall the local dogmatism that is one of the characteristics of the empiric, the obstinate guesswork practitioner. Consider differences in the preparation of teeth for onlays, three quarter crowns, etc. Think of the battle of articulators. Recall the controversy between those who employ the direct, and those who employ the indirect method in gold inlay work.

It is not that I would predict, or even advocate a deadening uniformity of thought or procedure: I mention these divergencies merely to draw your attention to the frequent dogmatism of those who preach and practice, a cocksure certainty that has nothing behind it but unchecked personal observation, unrecorded observations of improperly controlled cases.

As long as we insist on traveling the road of progress without the guide of control and system in observation and record, we enhance the opportunities of the charlatan and the quack, the men who continually beset us with half-baked ideas, with endless new "technics" that have never been through the fire of true research. With this goes hand in hand the vanity of those afflicted by the clinic and platform obsession, as well as the cupidity of those who seek to exploit us, and the public, with things to sell that are not worthy of use.

More erroneous conclusions are due to lack of information than to errors of judgment, so unless we can employ scientific methods of observation now, it might be better to have a moratorium for invention during which not a single new idea can be advanced for ten years, so that the profession at large may have an opportunity to work out some method of testing the ideas they already have in stock. So I desire to propose to this section on prosthesis that the time is ripe for a remedy for all this empiricism, that the say-so or dictum of any one man, no matter how skilled he may be, should not in the future be accepted without an impartial scientific trial by a group of dental teachers or research workers, no less than five in number. These teachers and investigators should be associated with a reputable dental institution and be entirely free from all commercial affiliations.

The remedy involves cooperation between the practitioner and the research worker, and the proper organization of research. All scientfic dental investigation should take the form of group research rather than mere individual observation. The proper place for group research is the infirmary of the dental college, where even today partial patient control is feasible. Patient control should be rendered more effectual by the institution of social service work. Groups should define and tabulate the phenomena they seek, the procedures to be adopted. Each case should be treated and appliances constructed under the observation of the investigating group. Social service workers employed by the college should keep in touch with the selected patients, bringing them to the infirmary at stated intervals so that the investigating group may study the progress of the treatment. To supplement this intensive application of

definite methods of record and observation, simple forms of charts should be supplied to practitioners desiring to cooperate in their own practices.

It will take time to develop such a system, but the germ of the idea may be found in the prosthetic infirmary of the dental department of Harvard University. In this department, partial dentures have been constructed under group observation, by students, during the past five years in accordance with a definite precision technic.

While a complete system of patient control has not as yet been worked out at Harvard, it has been possible for us to follow the work with subsequent group observations. What is the result? The technic employed in partial denture work at Harvard has been more thoroughly tested than any procedure could possibly be tested by the unchecked observations of any individual practitioner, no matter how well trained in observation he may be, working without these methods of record.

It was my opinion five years ago that unless some educational group did what I have briefly outlined, our progress in this interesting field would be very slow and halting. It seemed at that time that we had reached the point where we would progress no longer unless scientific work such as I have proposed was carried on. It has needed and will need in the future men of patience and courage, experienced in research, but willing to learn. It will need time and ample funds—but I believe some institution and some group of men will do it in the end, and all dentistry will profit by this exchange of science for empiricism.

In closing, I would point out for your consideration that group research and tabulation of results is nothing new in other fields of scientific endeavor. The main difference has been that these have had ample funds provided for such research. It is very possible nevertheless, if the need were acknowledged, that funds would be provided to make this dream a reality.

125 Marlboro Street.

## DISCUSSION

*William Dwight Tracy, New York City:* While Dr. Nesbett concentrates on questionable methods of procedure which are in use in partial denture prosthesis, we all realize that empiricism in dental practice is by no means confined to this field of work. We realize that such advances as have taken place in the progress of dentistry have always been based upon increase of scientific knowledge in connection with any given problem. We know that as the bright light of science reveals fundamental truths to us and as empiricism recedes into the background, our progress toward better standards of practice goes on apace. In these days of rapid advance in all fields of human activity, we frequently hear the optimistic statement that "nothing is impossible," and when an organized group of men and women are endeavoring to struggle onward and upward as the dental profession is doing today in order that they may render greater and better service to the human family that is a good slogan to adopt. We look with admiration and sometimes with amazement on the revelations made by research and investigation in the field of medicine. We may point with satisfaction and perhaps with some pride to the advances made in dentistry through the research endeavors of members of our own profession, but I fear that we have a long way yet to go before we can reach the goal toward which we are striving; namely, the prevention of dental caries. This of course must be regarded as our fundamental and ultimate aim, but during the evolutionary period which may some day lead us to a solution of this problem, we have other important and pressing demands on us, problems that may justly be termed problems of the hour. In other words, the conditions with which we are confronted today which are brought about primarily by the ravages of dental caries and disease must be met and taken care of. The patients to whom we minister must have the benefits of our treatment

based on such knowledge as is available at the present time. Groups of men who are seriously and energetically interested in finding ways and means to meet scientifically and cope with these immediate needs are sometimes criticized for not concentrating all their time and energy, their mentality and funds on the great fundamental problem of prevention. From the idealistic point of view this, this criticism may be just, but from the practical point of view, it is not just. I am glad to speak in support of Dr. Nesbett's position. Recognizing the fact that we now have to deal with patients who have been rendered partially edentulous and believing that this will be true for generations to come, he advocates that some steps be taken to improve the scientific status of partial denture design and construction. Dr. Nesbett knows without being told that the entire profession will sympathize with him in his desire to obtain truly scientific data in this study, and they will thank him for his effort to stimulate research along this line; but there are so many complications involved that it is going to be a difficult matter to get down to bed rock. We must not shy at an undertaking just because we know that it is difficult and complex. We must decide whether the end justifies the effort, and then having decided that the effort is worth while, must overcome the difficulties and break down the barriers to success. I would not wish to inject any note of pessimism into my comments, but it seems to me that the gathering of data in regard to the reactions of the teeth themselves, the periodontal tissues and the mucosa, when it carries the stress of tissue-bearing saddles, is going to be a complex undertaking. A partial denture of a carefully designed type may be inserted and worn with comfort and without damage to the teeth or other structures of the mouth in case A. A second denture of the same type may be inserted in the mouth of case B, in which all the conditions appear to be identical with those of the first case; but it would be my prophesy that when a check up is made on these two cases at later intervals, the results will show a decided difference between the two cases. These differences may be due to biologic factors quite beyond the control of either patient or dentist. Differences in the degree of occlusal stress, differences in the strength of the periodontal membranes and the varying capacity of the mucosa to carry the stress to which it may be submitted. Even though patients may be under complete control, the varying degree of health and vital resistance of these patients must necessarily influence the results of treatment in the cases which are being checked up. While we admit that chemistry is a complex subject, we do know that, in the hands of experts, it has been reduced to an exact science as Dr. Nesbett has pointed out. The same complicated experiment can be reproduced with the same end result any number of times, but in our work no such concrete state of affairs exists. I might almost say that the only factors that remain constant in the human mouth are the variables. Can these variables and these biologic factors be measured? Can they be evaluated and reduced to scientific data? I ask the question but do not attempt to answer it.

# HEAT TREATMENT OF GOLD-NICKEL ALLOYS

By JOHN S. SHELL, B.S., San Francisco, Calif.

THE crystal transformation of the gold-nickel alloys from a solid solution, which exists slightly below the melting range, to a eutectic mixture at a lower temperature makes possible a modification of the physical properties of such alloys by heat treatment. In the binary alloys, this transformation can readily be followed by microscopic analysis, and it indicates a radical change in crystal structure. Such changes usually induce a rather decided modification in physical properties.

Alloys of gold and nickel containing any great amount of the base metal are hard and brittle so that the preparation of homogeneous drawn wires is difficult. This fact makes the determination of tensile strength on such wires uncertain, and for this reason these tests have not been made. The alloys show almost no oxid occlusion and present a structure microscopically free from imperfections when melted under a flux such as boric acid or borax. This makes it possible to obtain reproducible hardness determinations on alloys of the same composition when treated identically. For this reason, the property of hardness was chosen as a criterion of changes in physical properties due to heat treatment.

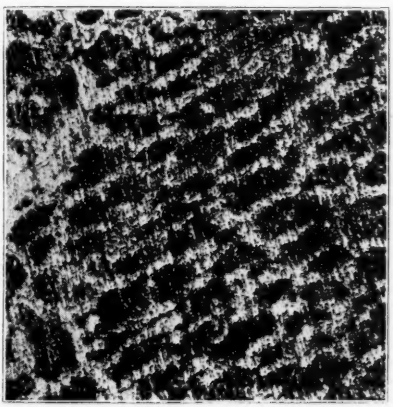


Fig. 1.—Gold nickel alloy containing 15 per cent nickel melted under borax and slowly cooled. (Slightly reduced from a magnification of 150 diameters.)

Fig. 2.—Gold nickel alloy containing 15 per cent nickel melted under borax and annealed at 700 F. for 16 hours. (Slightly reduced from a magnification of 650 diameters.)

Binary alloys containing from 5 to 25 per cent nickel at intervals of 5 per cent were first prepared and examined microscopically to insure freedom from visible imperfections, and were then tested with a Rockwell hardness tester using a one-sixteenth inch ball and a pressure of 100 kg. Such results are called "Rockwell B numbers" and can be compared, by suitable calculations, with hardness determinations obtained from other instruments. The diamond cone was also used on some of the harder specimens; but as none of the samples were much harder than B 100, the measurements were standardized by the use of the one-sixteenth inch ball. Table 1 shows the effect of the different heat treatments on the Rockwell hardness number. This instrument is so constructed that the magnitude of the number shown on the dial indicates the hardness of the specimen.

Each alloy was given four different heat treatments and the tests were made on duplicate samples until the readings checked to within three divisions on the Rockwell scale. The heat treatments were as follows:

1. The quenched specimens were prepared by melting the alloys under borax, allowing them to solidify and then removing them from the flux and quenching in water.

2. Annealing above the transformation point was accomplished by quenching the alloys as above and then heating at from 1400 to 1500 F. for four hours under a layer of molten borax.

3. Annealing the alloys at a lower temperature included a quenching process followed by heating to 1500 F. under borax, and, finally, cooling the furnace to the desired temperature and heating the alloys at this temperature for sixteen hours. They were then quenched in water.

4. Slow cooling was obtained by melting the alloys under flux and cooling in

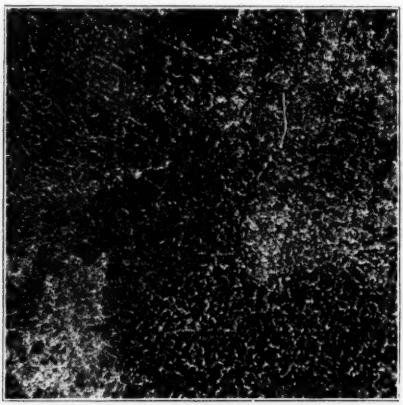


Fig. 3.—Gold nickel alloy containing 15 per cent nickel melted under borax and quenched in water. (Slightly reduced from a magnification of 30 diameters.)

Fig. 4.—Gold nickel alloy containing 15 per cent nickel melted under borax and annealed at 1500 F. for four hours. (Slightly reduced from a magnification of 30 diameters.)

the furnace. The furnace requires about three hours to cool from 1500 to 200 F., but cooling through the critical range occurs in less than one hour.

The hardness of the alloys containing 5 per cent nickel shows no effect of the heat treatment. This is to be expected from the fact that the microscopic examination shows no crystal transformation.

Table 1.—Hardness of Binary Gold Nickel Alloys
(Rockwell B numbers)

| Alloy % Gold | % Nickel | Quenched | Annealed 1400-1500 F. Above Transformation | Annealed 600-800 F. Below Transformation | Cooled Slowly |
|---|---|---|---|---|---|
| 95 | 5 | 65 | 63 | 65 | 65 |
| 90 | 10 | 90 | 95 | 90 | 90 |
| 85 | 15 | 99 | 101 | 87 | 93 |
| 80 | 20 | 104 | 105 | 85 | 92 |
| 75 | 25 | 104 | 105 | 80 | 90 |

Table 2.—Hardness of Gold Nickel Copper Alloys
(Rockwell B numbers)

| Alloy % Gold-Nickel | % Copper | Quenched | Annealed 1400-1500 F. Above Transformation | Annealed 600-800 F. Below Transformation | Cooled Slowly |
|---|---|---|---|---|---|
| 98 | 2 | 97 | 97 | 94 | 96 |
| 96 | 4 | 96 | 96 | 96 | 96 |
| 95 | 5 | 95 | 95 | 97 | 95 |
| 94 | 6 | 95 | 95 | 98 | 95 |
| 90 | 10 | 92 | 90 | 95 | 92 |
| 85 | 15 | 92 | 88 | 92 | 91 |
| % Gold 15% Nickel | | | | | |
| 90 | 10 | 99 | 99 | 90 | 90 |
| 85 | 15 | 96 | 96 | 93 | 92 |

The 10 per cent nickel alloys show an average difference of 4 points between the specimens that are annealed above and those annealed below the transformation temperatures, and this difference in hardness increases with the nickel content. The 25 per cent nickel alloy decreases 25 points when heat treated at the lower temperatures. The slowly cooled alloys also show a decrease in hardness which is never so great as in the alloys that are annealed for sixteen hours at the lower temperature. This difference in physical properties is also indicated by the variation in microstructure as shown in Figures 1 and 2. Figure 1 shows an alloy slowly cooled, and in Figure 2 the same alloy is shown after being annealed at a lower temperature for sixteen hours. Quenching seldom maintains the alloys in the hardest state, annealing at 1500 F. for four hours being necessary to increase the hardness to its maximum. Longer heating at this temperature has no effect on the hardness or the crystalline structure. Annealing at 1500 F. changes the dendrite structure shown in Figure 3

to the homogeneous grain structure shown in Figure 4.

The changes in hardness of ternary alloys containing gold, nickel and one other metal were next determined. For the purpose of comparison, an alloy of either 10 or 15 per cent nickel was first prepared and used as a stock alloy. The ternary alloys were then obtained by adding various proportions of the third metal. Copper was chosen because of the complication of hardening, owing to the fact that gold copper compounds occur at the same temperature as the gold nickel eutectic. Table 2 shows the results of these determinations.

The change in hardness of these alloys is notably less than those containing no copper. The modification of the hardness at the lower temperature is soon apparent, as alloys containing 4 per cent copper added to the 10 per cent nickel-gold show no decrease in hardness when annealed below the transformation point. As the copper content is increased, its effect is seen in the increased hardness of the specimens after low temperature annealing.

The ternary systems gold-nickel-silver, and gold-nickel-cobalt were also investigated. The alloys were prepared from a stock alloy containing the constant ratio of 85 per cent gold and 15 per cent nickel. To this alloy, various amounts of the third metal were added, and the whole was tested for hardness after being heat treated in the same manner as the other alloys. Table 3 shows the results of these determinations.

TABLE 3.—HARDNESS OF GOLD NICKEL ALLOYS WITH SILVER OR COBALT
(Rockwell B numbers)

| Alloy | | | | | |
|---|---|---|---|---|---|
| % Gold-15% Nickel | % Silver | Quenched | Annealed 1400-1500 F. Above Transformation | Annealed 600-800 F. Below Transformation | Cooled Slowly |
| 99 | 1 | 99 | 101 | 86 | 89 |
| 98 | 2 | 98 | 98 | 73 | 83 |
| 96 | 4 | 95 | 97 | 60 | 68 |
| 95 | 5 | 90 | 94 | 55 | 60 |
| 90 | 10 | 82 | 85 | 40 | 46 |
| % Gold 15% Nickel | % Cobalt | | | | |
| 99 | 1 | 100 | 100 | 86 | 89 |
| 98 | 2 | 100 | 100 | 84 | 87 |
| 96 | 4 | 98 | 99 | 80 | 83 |
| 95 | 5 | 95 | 97 | 80 | 83 |
| 90 | 10 | 94 | 95 | 70 | 75 |

Some dental alloys are known to contain gold, copper and nickel, with the addition of some other metals, and the complication of the heat treatment due to these combinations deserves consideration.

The change in hardness obtained by heat treating gold-nickel alloys is the reverse of that of gold-copper. The nickel alloys act like steel in that they are hardened by quenching from a high temperature and softened by annealing at a lower temperature. The copper gold

alloys are softened by quenching, and hardened by a low temperature annealing. This presents a duplicate nature to the heat treating of dental alloys containing both copper and nickel. In order to determine the effect of heat treatment on dental alloys containing these base metals, three proprietary alloys, A, B and C, were chosen which were known to contain both copper and nickel. The same forms of heat treatment were applied. The results of these determinations are shown in Table 4.

TABLE 4.—HARDNESS OF PROPRIETARY ALLOYS
(Rockwell B numbers)

| Alloy | Quenched | Annealed 1400-1500 F. Above Transformation | Annealed 800 F. Below Transformation | Cooled Slowly |
|---|---|---|---|---|
| A | 95 | 98 | 81 | 89 |
| B | 96 | 99 | 84 | 96 |
| C | 85 | 85 | 90 | 90 |

As such changes in hardness cannot well be attributed to the relatively small percentage of nickel present, transformation due to the presence of some of the other metals may be expected. Such metals may undergo crystal transformation when alloyed with gold, or they may act as catalysts for the transformations occurring in copper and nickel gold alloys.

These results indicate that the problem of heat treatment of dental alloys will be found eventually to be a rather complicated procedure, requiring a special technic for each alloy.

# ORAL SYPHILIS*

By PAUL A. O'LEARY, M.D., Rochester, Minn.

IT may be of interest to discuss briefly some of the many misconceptions prevailing in regard to syphilis and to call attention to the manifestations of syphilis that are of particular significance to dentists.

Historically, our knowledge of syphilis dates back to the time of Columbus. It has not been possible to elicit evidence to prove conclusively the existence of the disease previous to 1494. It is true that the epidemic that spread over Europe after the return of Columbus on his second voyage to this country may not have been the disease that we now call syphilis. Nevertheless, most medical historians do not accept the evidence which has been offered endeavoring to prove the existence of syphilis previous to the Columbian era. The influence that has masked the historic side of the disease has come down

*From the Section on Dermatology and Syphilology, the Mayo Clinic.

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through generations and has been greatly influenced by biblical training. This influence has been so prevalent that the disease has assumed a purely moral aspect in the minds of many, which is unfortunate, since, for this reason, the public health aspects of the disease have been lost sight of. In accepting the modern conception of syphilis, it is essential to recognize that syphilis is a public health matter rather than a moral one, and that the great number of infections acquired other than by sexual contact is proof of the necessity for public health measures in regard to the disease.

In certain European countries, where etiquette and custom necessitate personal contacts, extragenital infection by syphilis is common. In this modern era of hygiene, as it exists, for example, in this country today, extragenital infection by syphilis is less common. To dentists, this phase of the disease is an important issue. In my experience, extragenital infections have been more common among dentists than in any other group of professional men, owing to the fact that many of the infectious lesions of the disease are on the mucous membrane of the mouth.

Schaudinn and Hoffmann, in 1905, demonstrated the cause of syphilis to be an organism known as *Spirochaeta pallida.* This organism is not related in any way to the gonococcus, the cause of gonorrhea. The misconception of the relationship of the two diseases is undoubtedly due to the experiments of John Hunter, who gave his life to prove what unfortunately turned out to be a misconception.

When *Spirochaeta pallida* comes in contact with the skin, either through an abrasion or through the unabraded skin, it finds its way to the lymph spaces in the skin, and, within a period of approximately six weeks, there develops the so-called primary sore, or chancre. The induration or hardness of the chancre, which is one of its outstanding clinical features, may be evidence of an effort on the part of the body to overcome the invader. After the chancre has been present for one or two months, it heals spontaneously, and, at about this time, the so-called secondary manifestations of the disease appear.

During the prechancre stage of the disease, *Spirochaeta pallida* has been multiplying rapidly in the tissue adjacent to the point of inoculation, and the organisms have migrated to the adjacent lymph nodes, even before the chancre appears. From these areas, *Spirochaeta pallida* eventually gets into the blood stream, and the secondary manifestations of syphilis soon appear. The clinical signs of this phase of the disease are found particularly on the mucous membranes of the mouth and genitalia, the skin and the scalp. Because these organisms are floating about in the blood stream, the secondary lesions also appear in other parts of the body, such as the liver, the brain and the heart. It is at this time that the foundation is laid for the appearance, ten or twenty years hence, of the serious complications of the disease. For example, it is known that neurosyphilis, which may later manifest itself in the form of paralysis or locomotor ataxia, actually starts at the time of the secondary manifestations of the disease. The neurosyphilis may be dormant or quiescent for twenty or more years before it shows clinical features and, in fact, it is this period of latency which makes the disease so treacherous, because the average patient during this time has forgotten that he ever acquired the infection.

Late syphilis may involve any of the organs within the body, but has a predilection for the nervous and cardiovas-

cular systems, the skin, the mucous membranes, the bones, the organs of special sense, such as the eye and the ear, and certain of the viscera, such as the liver and the stomach. Hence, the problem of the treatment of syphilis is in a sense the problem of general medicine and not one that confines itself solely to the treatment of diseases of the genitalia.

Another sphase of syphilis which is important, because the lesions appear frequently in the mouth, is that known as the recurrent or relapsing type of the disease. It is observed in patients with a recently acquired infection who have been inadequately treated or not treated at all during the early manifestations of the infection. There is a group of patients, fortunately small, in whom, for some unknown reason, resistance to the infection has not developed, so that, for a period of years, these recurrent lesions continue to develop. In the average case, after syphilis is acquired, resistance or immunity to it develops, and there is a tendency for the chancre to heal and for the secondary manifestations of the disease to disappear. The spontaneous involution of these lesions is not evidence of the fact that the patient has been cured of syphilis because, as previously stated, the latent or quiescent stage of the disease develops, in which neither clinical signs nor symptoms are present. Certain patients remain in this state and live to old age without embarrassment from the disease; whereas, in others, serious complications may develop several years after the disease is acquired.

In considering the details of syphilis that are particularly applicable to dentists, a discussion of the extragenital type of chancre is warranted.

The lip is by far the most common site for extragenital chancre. The tonsil, finger, tongue, eye and gums are also common sites for the development of the primary lesion. The extragenital chancre is a variable type of lesion and, if I were to describe the clinical features of the classic hunterian chancre, I should describe only one of the many types of a primary lesion. This will be more readily understood if it is borne in mind that chancres vary in size from a small abrasion to an indurated, fungating mass. It is well to remember that a chronic ulcer which is indurated or hard, does not heal and is associated with painless enlargement of the adjacent lymph nodes is indicative of chancre. The exact means of determining the cause of this type of ulcer is a dark-field examination for *Spirochaeta pallida*. Frequently, if *Spirochaeta pallida* is not obtained from the ulcer suspected of being a chancre, aspiration of the adjacent enlarged lymph nodes with a small needle may demonstrate it.

The age of a patient should not be a factor in arousing the suspicion of a chancre; nor is the station in life of any significance. In a review of a large series of cases recognized during the acute manifestations of syphilis, evidence of a chancre was not shown in 24 per cent. In other words, the secondary lesions may appear without the development of a chancre as a result of the direct invasion of *Spirochaeta pallida* into the lymph stream or blood stream.

The recognition of the bubo, or the swelling of the lymph nodes adjacent to the chancre, is one of the paramount factors in the diagnosis of extragenital chancres, particularly about the mouth. The bubo is painless, does not as a rule suppurate and frequently is not recognized by the patient. The lymph nodes are not particularly hard when palpated, and may appear in clumps or in a chain-like arrangement. In the differential diagnosis of extragenital chancres about

the mouth, the possibility of gumma or late syphilitic lesions, tuberculosis, chancroid, fungus infections of various types, herpes and malignancy must be borne in mind.

I should like to emphasize that in the diagnosis of a lesion suspected of being early chancre, the Wassermann reaction of the blood may not be of value, because, frequently, the reaction does not become positive until the chancre has been present for several weeks. Therefore, the acceptance of a negative report on this test may lead to an erroneous diagnosis. In certain cases, if a Wassermann test is made of the serum obtained directly from the chancre, a diagnosis may be made before the Wassermann test of the blood has become positive.

Although the secondary manifestations of syphilis as they appear on the skin are too numerous and bizarre to warrant description here, it is important to emphasize the characteristics of the secondary lesions as they appear in the mouth. If a syphilitic papule appears on the mucous membrane of the mouth it may be expected that the surface of this papule will soon become macerated and eroded, and *Spirochaeta pallida* will swarm on the eroded surface. This lesion is known as a mucous patch. Mucous patches may be single or multiple, and they may involve practically all of the mucous membrane of the oral cavity. The presence of the single mucous patch is serious because of the fact that it often remains unrecognized for a long period of time, and, of course, is a constant source of contagion. The mucous patch is not painful, and unless the lesions are numerous, patients are, as a rule, not aware of its existence.

A similar type of lesion may develop about the genitalia, and if it happens to develop at a site where the mucous surfaces are in constant contact, the so-called condyloma latum forms, which is merely a mucous patch that has undergone papillomatous proliferation.

Examination for *Spirochaeta pallida* from the mucous patch should be done only by an expert, as numerous other organisms, particularly *Spirochaeta microdentium,* a normal inhabitant of the mouth, closely resembles *Spirochaeta pallida* and is likely to be mistaken for it. Accordingly, a diagnosis of syphilis should not be based solely on the recognition of a spirochete obtained from the mouth which resembles *Spirochaeta pallida.* In association with the development of the secondary lesions, alopecia, or loss of hair of the scalp and eyebrows, may be noted, in addition to constitutional symptoms such as malaise, loss of weight, headache and gastro-intestinal upsets, or, if the involvement is severe and extensive, complications in the nervous system or viscera.

The secondary lesions of syphilis are often evanescent, tending to heal spontaneously and to reappear, this depending on the patient's resistance to the infection.

The recurrent lesions as they appear on the mucous membranes are similar to the secondary lesions, and differ only in that they usually appear singly and are not associated with constitutional symptoms.

The late lesions of syphilis of the mucous membrane and skin are also of significance to the dental profession, not so much from the standpoint of contagion as from that of diagnosis or the recognition of a previously unrecognized or forgotten disease. The late lesions on the skin, known as gummas, may be single or multiple. The lips and the face are common sites for the development of these gummatous lesions. If a number of gummas appear close together, they

coalesce, ulcerate and form the characteristic lesion known as a nodular ulcerative syphilid. Suffice it to say that induration or hardness and a tendency toward spontaneous healing, pigmentation, scarring and atrophy are features of these late cutaneous syphilids. Late lesions may vary in size and in the degree of involvement.

Lesions of the skin and mucous membrane of late syphilis are for practical purposes considered not to be infectious. It is true that gummas are caused by *Spirochaeta pallida,* but the organisms are so few that the degree of infectiousness of the lesions is insignificant in contrast to the chancre or mucous patch. Nevertheless, it behooves one to adopt aseptic measures when carrying out treatment or operation in such cases.

Contrary to the general conception of the disease, syphilids of the skin are, as a rule, an index of the benign features of the disease. Leukoplakia of the mucous membrane as observed during the late phases of the disease is of diagnostic value and of particular significance because, frequently, it is the forerunner of carcinoma. The recognition of atrophic glossitis with associated leukoplakia often permits of a diagnosis of syphilis in cases in which the Wassermann reaction of the blood repeatedly has been negative. Syphilitic leukoplakia usually is found on the tongue and cheeks, particularly at the angles of the mouth. Leukoplakia as the result of syphilis may be distinguished from traumatic leukoplakia by its site; by the associated atrophic glossitis; by the presence of the striae or linear configuration of the leukoplakia, and by the tendency to a bluish grayness.

Leukoplakia is often the site of the development of carcinoma. To treat the leukoplakia only in the hope thus to avoid the possibility of carcinoma may be doing only half of what is necessary. I believe, therefore, that it is essential to treat the syphilis, which is known to produce leukoplakia, as well as to remove the leukoplakia, which may undergo malignant change.

The development of the gummatous lesions of the bony structures of the mouth is not uncommon and results in the disfiguring perforations which are readily recognizable.

Our knowledge regarding the influence of syphilis on the adult teeth is meager. On the other hand, the influence of congenital syphilis in producing the classic hutchinsonian teeth is common knowledge.

### TREATMENT

The conception has prevailed for many years that the use of mercury in the treatment of syphilis often results in destruction of the bony structure of the oral cavity. On my service in the Mayo Clinic, it is insisted that all patients with gingivitis, cavities and poor dental work have their mouths attended to before treatment is started. As the result of this procedure, we have reduced mercurial stomatitis to a rarity.

Various preparations of bismuth have been developed during the last few years as an adjunct in the treatment of syphilis, and particularly to supplant mercury. The constitutional and local reactions from bismuth are less severe than from mercury. The appearance of a "bismuth line" does not necessitate the discontinuance of its use, although occasionally severe ulceration of the mucous membrane will be noted. In the treatment of patients with syphilis, the proper care of the mouth is one of the cardinal essentials. The common practice among many dentists to shun such cases must be laid to lack of realization of what can be done

for the patient rather than to fear. If the dental and medical groups were more in accord in this one phase of the treatment, many unnecessary complications would be avoided and a higher percentage of therapeutic cures would prevail, because therapeutic complications lead many patients to discontinue treatment.

The arsphenamins, the U. S. Pharmacopeia name for the various "salvarsan" preparations (606 and 914), are the outstanding remedies in the control of the infectious lesions of syphilis. In the well-organized clinics of this country, the results show that about 75 per cent of patients with acute syphilis who adhere to the therapeutic program outlined for them will be cured. Certain selected types of cases will show cure in more than 90 per cent of cases. The older the disease and the more advanced the complications, the more difficult it is to obtain a cure. In these types, our efforts are directed toward the relief of symptoms and the arrest of the progress of the disease.

It is indeed fortunate that we have at our command such a potent remedy as arsphenamin and its derivatives, to control the infectious lesions of syphilis. In practice, within twenty-four hours after an injection of the drug, it is difficult to find an active *Spirochaeta pallida* from any of the so-called infectious lesions. The sterilizing quality of the drug gives it a public health value that is paramount, as it requires that the patient with acute infectious lesions of syphilis remain in quarantine for a few days only. This one dose is, of course, not curative, and must be followed by the intensive use of arsphenamin and either bismuth or mercury.

## PROPHYLAXIS

My answer to the question so frequently asked me by dentists, "How shall we avoid infection from syphilis?" may be summarized briefly as follows:

A suspicion of syphilis should be constantly in the minds of men working in mouths. I say this not because I am a syphilologist, but because it is a conservative estimate in this country that practically 12 per cent of the population has, or has had, a syphilitic infection. In other words, there is a possibility that one out of every ten patients who come to a dental office has, or has had, the infection. The liberal washing of the hands with soap and water is a simple and efficient method of prophylaxis that should be practiced repeatedly in every case. Of course, the thorough sterilization of all instruments used in each mouth should be a regular procedure in every dental office.

It is necessary to take particular care of the hands, avoiding hangnails, abrasions and trauma which might predispose these wounds to the entrance of *Spirochaeta pallida.* If a patient with acute syphilis of the mouth is urgently in need of dental care, the use of rubber gloves followed by thorough washing of the hands with soap and water is as a rule a sufficient precaution.

If at any time the operator's fingers should be traumatized while he is working in the mouth of a patient with acute syphilis, a series of injections of arsphenamin should be taken. The essential feature in the use of prophylactic arsphenamin is to receive the injections immediately after the injury is received. Statistics show that the value of this preventive form of treatment is in inverse proportion to the time interval between the injury and the time of injection of the arsphenamin. In cases in which there is a suspicion of the presence of acute syphilis and the dentist has abrasions on his fingers, the use of mercurous chlorid

(calomel) ointment massaged into the wounds for five minutes may be all that is necessary.

My advice may be summed up in urging a suspicious attitude with regard to the presence of syphilis. When the suspicion is acute, the dentist should seek medical and laboratory aid in confirming or dissipating the suspicion.

DISCUSSION

*Frank W. Rounds, Boston, Mass.:* This is a very timely subject. We who have been in practice for some time have forgotten a good deal of the theory that we learned in college. In busy practices, we are prone to overlook the obvious things. Dr. O'Leary has brought to our attention our paramount duty to ourselves, to our patients and to the public at large, and I believe that, from time to time, a paper of this character is a great thing for us all. We must bear in mind that the dentist is in constant danger of acquiring these extragential infections. I feel that every case that comes under our observation, whether in general or surgical practice, must be considered as a possibility. It makes no difference what the sex, what the age, what the station or the position in life may be, this disease is no respecter of persons, and we should always be on guard. The dentist must necessarily obtain his information from clinical observations. His attention is naturally drawn to mouth conditions. He might overlook the scalp presentation of symptoms, but if he is careful in his observation, if he is very painstaking in any preoperative observation of a mouth, he cannot fail to observe some of these symptoms as they present themselves in the mouth. It is, of course, as Dr. O'Leary has said, the first and secondary manifestations that we as dentists are primarily interested in. One point that I would like to call to your attention in connection with the closer cooperation which Dr. O'Leary suggests between medical and dental men is this: In my experience it is very rarely that I have had any medical advice as to the exact situation with patients who come even from medical references. Perhaps the physician is flattering me by possibly thinking that I have more knowledge than I have, but he often fails to advise me that the patient is under treatment. Again, the patient is always very reticent in presenting these facts to the dentist. Whether it is through fear or through ignorance, often they let the facts slip by and do not advise the dentist and it therefore devolves upon the dentist himself to look for these diagnostic signs, because he must get his information in that way. I feel, then, that we should make it a routine to develop our powers of observation so that unconsciously we are looking for these diagnostic signs, and we must learn to recognize the mouth manifestations of the first and second stage. In other words, we should always be suspicious. From a practical point of view, for our own safety, we should consider patients guilty unless we have evidence that they are innocent. One important point, to my mind, that Dr. O'Leary brought out was the glandular involvements near the area of the lesion. We are possibly prone as dentists to connect all of these glandular developments with the teeth. We are likely to think of the swollen gland as the result of an acute abscess or a part of the process of an erupting third molar, and we are thinking of it in terms of teeth, but we should bear in mind that these swellings and inflammatory conditions around the angle of the jaw, around the neck, when connected with either abscessed or erupting teeth, are always the result of a suppurative process and are accompanied by the classic symptoms of an inflammatory process, and these glandular lesions of which he speaks, are of a painless character, and there we get a differentiation. Every dentist is able, of course, to recognize or should be able to recognize the mucous patch. Now I feel that it is not essential for the dentist to be a diagnostician of this disease in any sense of the word. That is the medical province, but we can certainly cooperate by taking account of any of these suspicious symptoms and seeing that the patient is referred to a physician. Whether it is a specific condition, a tuberculous condition, a malignant condition or what not, his paramount duty is to advise competent medical care and further still, if it is at all possible, to see that his suggestions are carried out. From the dentist's point of view, if he is at all suspicious, I feel that it is wise to assume that it is syphilis and he can stand corrected if the patient has carried out his suggestions. We should also bear in mind that no manifestations may be evident and therefore we must take the same precautions as far as our

own protection is concerned that we would take if the patient showed definite lesions. Having seen the patient properly referred and having taken all the precautions, the one remaining duty of the dentist is cooperation between physician and dentist. In my experience, in recent years I have seen much less mercurial stomatitis than in years gone by. This may be due to the fact that the physician today is urging closer cooperation. He is urging his patients to keep their mouths in condition, and I think that possibly some of the improvement in the situation is due to improved methods of dental practice. When we recognize a syphilitic condition in a patient, it is our duty to take prophylactic care of the case ourselves and not turn the case over to our hygienists, for their protection, and further we must bear in mind that this is a personal matter between us as dentists and the patient. In the public health campaign, our assistance is just as important in this connection, it seems to me, as it is known to be in the early recognition of precancerous lesions. We have a double duty here to the world at large. We can there be of immeasurable help to the physician and to the public. I hope that Dr. O'Leary will tell us at what point we can consider the patient under treatment to be safe from communicating this disease.

*Earle H. Thomas, Chicago, Ill.:* If there is one respect in which dentists may be accused of being careless, it is this: the recognition of syphilitic lesions around the mouth. Carelessness may have very serious consequences, not only to patients, by the transferring of infection from one to another, but also to the dentist himself. As Dr. Rounds said, it would be presumptuous for one of our limited knowledge of the scientific phase of this subject to try to discuss it from that angle. The only thing that we can do in discussing such a paper is to emphasize some of the main points and possibly ask questions about some of the others. Dr. Rounds has made such an excellent impromptu discussion that there is no need for me to go over those same points and emphasize them. I will pick out just two more that he did not mention. One of them is the fact that a Wassermann reaction is not positive until some time after the appearance of a chancre. A dentist may not be careless. He may look for or suspect the presence of syphilis when he sees a certain lesion around the mouth, and he may see that the patient has a Wassermann test made. The report on this test may be negative, and he may then erroneously conclude that his suspicions were unfounded. That is an important point to keep in mind. The other point is that when a wound of any kind around the mouth does not seem to heal as fast as it should, the dentist should be very suspicious and look into the question as to whether or not the patient has syphilis. Many times we hear discussions about the prevalence of syphilis. It may be that a nose and throat man feels that everybody has nose and throat trouble, a skin man always feels that practically everybody has some kind of skin trouble, and some of these syphilologists seem to leave the impression with us that practically everybody has syphilis. This question comes up so often that I would like to have Dr. O'Leary inform us as to about what percentage of the public possibly have syphilis.

*George W. Christiansen, Detroit, Mich.:* I realize that we are not called on to make final diagnoses, but in involvements of the tongue, a condition may arise the nature of which it is difficult to determine. We know that tertiary or late syphilis frequently shows a negative blood Wassermann reaction. When we find a lesion on the tongue, with glandular involvement in the cervical region and a negative blood reaction, how are we to differentiate a gummatous lesion from a malignant one? Furthermore, is a negative spinal fluid reaction proof that syphilis is not present?

*Eugene Schmitt, Chicago, Ill.:* Assuming that we have discovered the chancre and the condition is active, are we justified in interfering surgically by opening a new lesion, and if so, are we permitted to use a local anesthetic or is nitrous oxid indicated?

*J. P. Wahl, New Orleans, La.:* Is there any difference in the roentgenographic findings in syphilitic cases, and if so, what difference?

*Dr. O'Leary (closing):* The point raised by Dr. Rounds in regard to the lack of cooperation between dentists and physicians is a very pertinent one, and I think that the responsibility for the existing situation rests upon the physicians. I mean that we are the ones who are lacking in cooperation rather than you dentists, although this, in a measure, is not all due to the physician but rather to

the general attitude in regard to syphilis. I believe that we are on the verge of a campaign for the dissemination of knowledge of syphilis similar to the campaigns that have been and are being waged in regard to tuberculosis and cancer, because we must get away from the fact that everybody who has syphilis is unmoral or immoral, whichever way you wish to look at it. We must too realize that it is essentially an infectious disease that is apt to occur to anyone who comes in contact with the germ. In other words, it is a public health measure. It is not a venereal or a pedagogic problem to be solved from the pulpit. The value of enlarged glands in the diagnosis of the chancre should be stressed forcibly. I purposely did not mention the character of the glands secondary to carcinoma. There is a clinical distinction. The bubo is usually a much larger gland. It is softer, painless and of short duration, in contrast to the glands of carcinoma, which are usually smaller, more numerous and of longer duration. I believe Dr. Christiansen asked the question regarding how we are going to differentiate these glands. In our experience, there is only one way of absolutely differentiating them, and that is by microscopic examination. In other words, a biopsy may be necessary because, when we rely solely on our clinical judgment in the diagnosis of glandular enlargements, we miss quite a percentage of them. I purposely avoided a discussion of the Wasserman test in late syphilis. A conservative numerical estimate of the value of the Wassermann test is about 70 or 75 per cent, except in late mucous membrane syphilis, in which it approximates 50 or 55 per cent. An explanation for this is hard to give, but it is a fact that, in endeavoring to confirm the impression that a leukoplakia is syphilitic, we will miss the diagnosis in almost half of them if we rely solely on the Wassermann test. I should like to stress again and call your attention to the fact that there is a clinical distinction between traumatic and syphilitic leukoplakia. The question as to the duration of the infectiousness of acute syphilis must be left unanswered specifically. I said that the primary, the secondary and the recurrent stages were the infectious ones; but, in practice, I believe that dentists working in the mouth in which there may lurk an insignificant mucous patch must consider all syphilitics infectious. Consider them so, and use soap and water liberally on your hands, because there is not a better prophylactic application than plenty of soap and water, which kills *Spirochaeta pallida* readily. Sterilization of instruments, not chemical sterilization, but sterilization by boiling, is a necessary procedure in all cases, syphilitic or otherwise. An estimate of the prevalence of syphilis in this country of course depends on the enthusiasm with which one approaches the subject, but I believe a conservative estimate from clinics and hospitals does not exceed 12 per cent. At the Mayo Clinic, it is less than 6 per cent, showing the variation in the locality from which the estimation is made. Of course, the negro is a factor in the higher percentage of syphilis in the South. The points in regard to congenital syphilis I omitted too, because I feel that is a subject in itself, particularly to dentists. You are more familiar with the characteristics of syphilitic teeth than we are, and I felt there was no need of reemphasizing them. I know of no particular influence that syphilis has in the teeth of an adult patient who acquires the disease. I know of no distinction that the roentgenogram shows as an aid in the recognition of syphilitic teeth. We do see syphilitic osteitis in the jaw, just as we see syphilitic periostitis and osteitis in other bones. Otherwise, I know of no way in which we can get a suggestion that a patient has syphilis from a roentgenogram of his teeth. The question in regard to the spinal fluid examination is a pertinent one. We make it a routine procedure to examine the spinal fluid of every patient because of the fact that a great many patients have positive spinal fluid and negative blood by the Wassermann tests, which means that they have neurosyphilis. It implies also that they are in the process of developing locomotor ataxia, paresis or some of the other serious neurologic consequences of the disease. If an individual has a negative spinal fluid, he is at least not in the process of developing neurosyphilis at that time, but the entire question is dependent on the stage at which that spinal fluid is examined. If examined during the chancre stage, one negative test is not conclusive, because if we examine the same patient six months later, he may have a strongly positive fluid. We can safely say that if the spinal fluid is negative in a patient who has had the infection five or six years or more, and there are no clinical signs of

neurosyphilis, we can rest assured that he will not develop neurosyphilis. We should bear in mind that the status of the Wassermann test at present is in a period of transition. We are using new tests now, such as the Kolmer test and the Kahn test, which is a precipitation test. The latter is simpler and affords about the same degree of accuracy. Undoubtedly, as this test becomes more common, it will be less expensive.

# SOME NEW CONCEPTIONS OF TOOTH FORM AND TOOTH ARRANGEMENT*

By MAX M. SCHWARTZ, D.D.S., Jersey City, N. J.

OF the many ways of establishing the opening relation[1] between the maxilla and the mandible, the one most commonly employed is that of building the maxillary occlusal rim slightly longer than the upper lip and the mandibular occlusal rim slightly shorter than the lower lip. This establishes the opening relation from the point of view of esthetics. (Fig. 1.) But this established opening relation may not be the acceptable opening from the point of view of mechanics.

Sound mechanics demands that the maxillary and mandibular ridges be parallel with each other, and that the guiding surfaces of the teeth be parallel with both ridges and directly over their crests. When the ridges are parallel, it is possible to set the teeth so that the forces of occlusion will be at right angles to both ridges. (Fig. 2.) This arrangement gives the maximum of stability of both dentures.

If the ridges are not parallel, it is not possible to have the forces of occlusion at right angles to both ridges. As a consequence of the lack of parallelism of the ridges, one or both dentures will tend to become unseated during closure pressure. For example (Fig. 3), if the ridges form an angle with each other and the guiding surfaces of the teeth are set parallel with and over the crest of the mandibular ridge, the forces of occlusion are at right angles to the mandibular ridge and the mandibular denture tends to remain stable. The maxillary denture tends to become unseated because the forces are not at right angles to the maxillary ridge.

If the guiding surfaces of the teeth are set parallel with and over the maxillary ridge, as in Figure 4, the maxillary denture will tend to remain stable because of the favorable direction of the forces of occlusion, but the mandibular denture will tend to shift because of the unfavorable direction of the forces of occlusion. If the guiding surfaces of the teeth are not set parallel with either ridge, both dentures become unstable. (Fig. 5.)

*Read before the Research Session at the Sixth Annual Meeting of the American Association of Dental Schools, Chicago, Ill., March 26, 1929.

1. Hanau, R. L.: Denture Space and Its Relation to Function, Chicago Dent. Soc. Bull., 9:1 (Aug.) 1928. Park, A. K.: Lost Vertical Dimension, Dent. Digest, 33:451 (July) 1927. Boyce, A. E.: Occlusions, Jaw Relations and Ridge Relations, J. A. D. A., 14:125 (Jan.) 1927. Sears, V. H.: Art Side of Denture Construction, Dent. Digest, 29:764 (Nov.) 1923.

It becomes evident, therefore, that the maximum stability of the dentures is possible only when the opposing ridges are parallel with each other, and when the guiding surfaces of the teeth are set parallel with and over both ridges. It also becomes evident that when the ridges form an angle with each other, "the anterior component of force" cannot be "nullified."

Usually, at the established opening relation for esthetics (Fig. 1), the ridges are found to be parallel with each other.

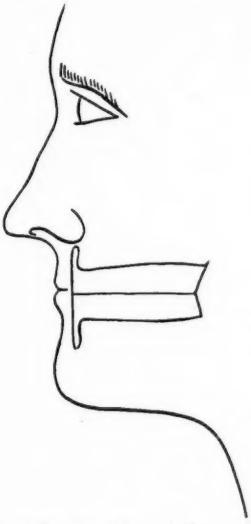

Fig. 1.—The opening relation as usually established for esthetics.

If, at the established opening relation for esthetics (Fig. 1), it is found that the ridges are not parallel with each other, the opening relation may be changed slightly to obtain the necessary parallelism. If the ridges form an extreme angle with each other, it will require too much change to obtain the parallelism, and, therefore, in such case, one must accept a compromise position which will give neither the greatest degree of esthetics nor the maximum mechanical efficiency. In extreme cases, as mentioned, it is not possible to give the patient both esthetics and mechanical efficiency; something must be sacrificed.

I have stated that the guiding surfaces of the teeth should be parallel with and over the crests of the ridges. Perhaps this statement needs clarification. If anatomic forms of teeth are used, the mesially inclined planes of the mandibular biscuspids and molars are the guiding surfaces in the centric protrusive

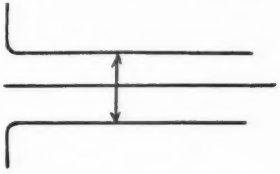

Fig. 2.—Ridges and tooth guidances parallel (buccal view). The arrow shows the forces of occlusion at right angles to ridges and tooth guidances, as demanded by good mechanics.

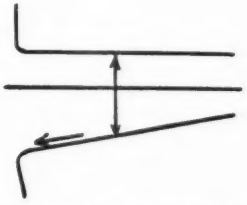

Fig. 3.—Ridges forming an angle with each other; tooth guidances set parallel with mandibular ridge. The arrows show forces of occlusion maintaining the stability of the mandibular denture but dislodging the maxillary denture.

movements. (Figs. 6 and 7.) Therefore, the mesially inclined planes of the mandibular bicuspids and molars should be set parallel with and over the crests of the mandibular ridge to obtain the maximum stability of the mandibular denture. This is evident since the forces of occlusion are at right angles to the

mesially inclined planes and will, therefore, be at right angles to the mandibular ridge, if these mesially inclined planes are set parallel with the mandibular ridge. (Figs. 8 and 9.)

This is quite different from what we have heretofore been taught. Heretofore, we have been taught that the forces of occlusion are in line with the long axes of the teeth, and that the long axes of the teeth should be at right angles to the ridge. Figure 10 demonstrates that condition and shows that we have heretofore been setting teeth improperly. It will be noted that when the long axes of the teeth are at right angles to the ridge, the mesially inclined planes of the bicuspids and molars are not parallel with the ridge and the forces of occlusion are in a direction which will tend to unseat the dentures.

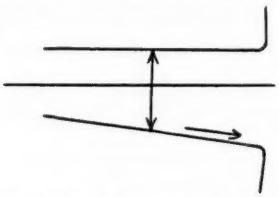

Fig. 4.—Ridges not parallel with each other. The tooth guidances are parallel with maxillary ridge. The arrows show the forces of occlusion maintaining the stability of the maxillary denture but dislodging the mandibular denture.

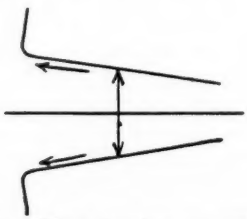

Fig. 5.—Ridges forming an angle with each other; tooth guidances not parallel with either ridge. The arrows show the forces of occlusion dislodging both dentures.

If we desire to use the interlocking anatomic forms of teeth and set them correctly, so that the mesially inclined planes of the mandibular posterior teeth are parallel with and over the crests of the mandibular ridge, we find that we shall have to "step" the teeth or grind practically all of them; and then, perhaps, we learn that it will be impossible to use them because of the anatomic limitations. (Fig. 9.) It becomes necessary, therefore, if we wish to give the patient the maximum service, the maximum masticatory functional efficiency with the least amount of trauma, that we use suitable tooth forms.

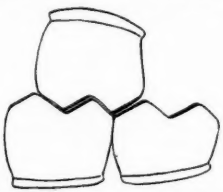

Fig. 6.—Buccal view of interlocking anatomic posterior teeth in centric occlusion.

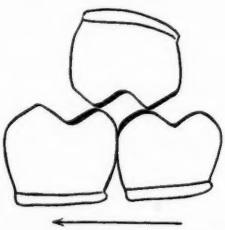

Fig. 7.—Buccal view of anatomic posterior teeth in protrusive occlusion. The arrow shows the direction in which the mandible moved from centric to protrusive relation. The heavy black inclined planes (guiding surfaces) are the tooth surfaces that were in contact during the movement to protrusive.

The interlocking tooth forms, so long in use, are now seen (both theoretically and clinically) to be unsuited to the

peculiar conditions of the edentulous mouth.

The basic conception of universal parallelism for occlusal surfaces and opposing alveolar ridges as formulated by Sears of New York was, perhaps, the starting point from which he evolved the entire new system of tooth form and tooth arrangement. The system of tooth arrangement, which is built upon sound mechanical principles, is closely bound up with the so-called Sears channel posterior type of teeth.[2]

These teeth as viewed from the buccal side have no cusp height. (Fig. 11.) Since there is no cusp height, there is no such thing as "mesially inclined planes." The entire occlusal crest is one continuous plane, and it is the guiding surface in the centric protrusive movement. It therefore becomes possible for us to set these teeth parallel with the mandibular ridge, as good mechanics demands. The forces of occlusion are at right angles to the occlusal crests and are also at right angles to the underlying ridges, thereby giving the maximum of stability to the dentures during function. (Fig. 12.) It follows that if the dentures are stable, the underlying tissues are not traumatized to any great extent and the maximum stability gives the minimum of trauma.

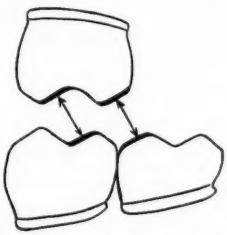

Fig. 8.—Direction of forces of occlusion at right angles to the mesially inclined planes of mandibular anatomic posterior teeth, in centric-protrusive movement.

These teeth are mechanical in form, not anatomic, and are designed to meet the artificial conditions under which artificial dentures function.

All of the nonanatomic posterior tooth forms (of which there are several) in which no projections impede the centric protrusive movement can be made to fit in with the principles above mentioned. This principle of paralleling all guiding surfaces at right angles to the direction of force is fundamental, good mechanics, obviously impossible with anatomic tooth forms.

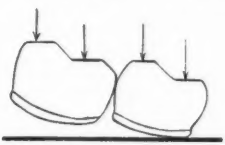

Fig. 9.—Mandibular anatomic posterior teeth correctly set showing mesial inclined planes parallel with mandibular ridge (represented by heavy black line). The arrows show forces of occlusion at right angles to tooth guidances and ridge.

This holds true not only for centric relation, but also for any protruded relation. The only way of applying the principle in the various jaw relations is to face all related facets or guidances according to a system. Otherwise, the teeth may be correctly placed only for certain relations and not for all of them.

2. Boyce, A. E.: A Review of Full Denture Theories, J. A. D. A. 15:2267 (Dec.) 1928. Jordan, L. G.: Means of Minimizing Shifting of Full Denture Bases, J. A. D. A., 15:2220 (Dec.) 1928. Sears, A. W.: Functional Teeth for Artificial Dentures, Dent. Forum, December, 1928. Sears, V. H.: Suggestions for Arranging Channel Posteriors, Lab. Technician, 1:8 (May) 1928; Channel Type Posterior Tooth Forms, J. A. D. A., 15:1111 (June) 1928; Suggestions for Grinding Channel Posteriors, Lab. Technician, 1:9 (June) 1928.

Face all guidances toward a center which we shall call the protrusive articulating center for protrusive balance, and lateral articulating center for lateral balance.

The protrusive articulating center, discovered by Sears, is found by drawing a perpendicular from the center of the condyle guide and another perpendicular from the center of the area of greatest support of the mandibular ridge, the area anterior to the second molar region. The intersection of these two perpendiculars is called the protrusive articulating center. (Fig. 13.) If all guides and guidances face this center, the forces of occlusion will be at right angles to the tooth guidances, and we will get balance in the centric protrusive movement regardless of any other factors. (Figs. 14 and 15.)

Fig. 10.—Diagram showing how anatomic posterior teeth have been set improperly. When the long axis of the tooth is at right angles to the ridge, the forces of occlusion are against the mesially inclined planes of the mandibular posterior teeth and dislodge the denture.

Fig. 11.—Mandibular channel posterior teeth (buccal view). Note the absence of interlocking cusps.

This center is not always fixed; it may be movable. It is not the Monson center nor Wadsworth center, nor does it coincide with any other center that has heretofore been placed before the profession. Those students desiring more details of the protrusive articulating center are referred to a paper by Sears[3] and also a paper by me.[4]

This center leads to many new ideas with reference to theories of tooth arrangements, among which we may state the following:

1. The plane of orientation is not the factor which insures balanced occlusion.
2. The cusp height is not the factor which insures balanced occlusion.
3. The compensating curve is not the factor which insures balance as has been commonly supposed. The thing which insures balanced occlusion in the centric protrusive movement is the placement of the tooth guidances so that they face the protrusive articulating center. This

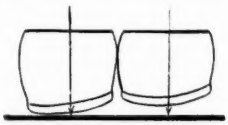

Fig. 12.—Buccal view of mandibular channel posterior teeth showing occlusal crests set parallel with mandibular ridge, and forces of occlusion at right angles to occlusal crests and ridge, as demanded by good mechanics.

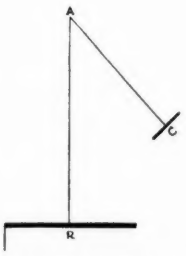


Fig. 13.—Protrusive articulating center *A* established by erecting a perpendicular upon the condyle guide and a perpendicular upon the mandibular ridge at the first molar region.

3. Sears, V. H.: J. Dent. Res., June, 1928.

4. Schwartz, M. M.: Some Important Considerations in Tooth Arrangement, J. A. D. A., 16:606 (April) 1929.

principle holds true regardless of the kind of teeth used.

There are lateral articulating centers which control tooth arrangement for lateral balance—as shown in Figure 16.

These newer conceptions of the problems of articulation have resulted in the design of channel posterior teeth heretofore mentioned. These tooth forms permit of arrangement in accordance with the newer conceptions of tooth arrangement. Let us consider some points in the

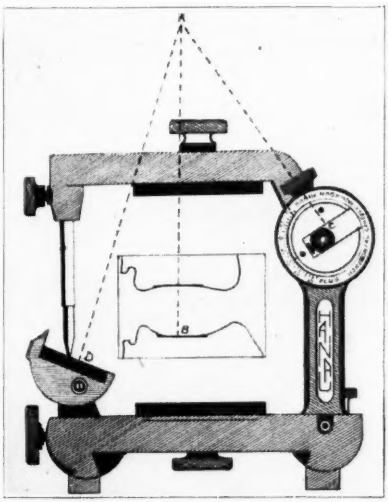

Fig. 14.—Opposing ridges parallel. Condyle guide and incisal guide facing protrusive articulating center *A*.

arrangement of channel type posterior teeth.

Each maxillary posterior tooth has a buccal and lingual cusp with a channel running across the occlusal surface in a mesiodistal direction between the buccal and the lingual cusps. On the buccal cusp, there are V-shaped elevations which assist in cutting food. (Figs. 17-19.)

Each mandibular posterior tooth consists of but one cusp. A buccal slope and a lingual slope meet to form a sharp crest in the center of the tooth. The crest runs in the mesiodistal direction. (Figs. 20-22.)

When the teeth are arranged, the crests of the mandibular teeth are set over the center of the mandibular ridge and faced toward the protrusive articulating center. The maxillary teeth are arranged so that the centers of the channels are in contact with the crests of the mandibular teeth, and protrusive and lateral balance are established. (Figs. 23 and 24.)

Because of the free mesiodistal gliding tooth surfaces, the effect of the channel

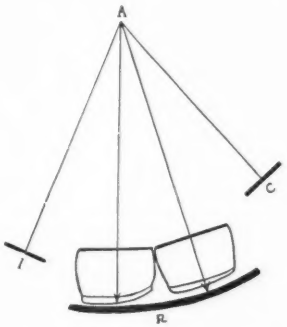


Fig. 15.—Condyle guide, incisal guide and tooth guidances facing the protrusive articulating center *A*. Note the tooth guidances parallel with the mandibular ridge and the forces of occlusion at right angles to the tooth guidances and ridge.

and crest arrangement is to minimize the dislodging forces in the centric protrusive movement. This arrangement also permits of protrusive balance without locking of the dentures even though there may be an extreme horizontal overbite. The channel permits a limited lateral freedom of movement without lock.

The tooth forms permit the maxillary and mandibular occlusal surfaces to be set in a line of force to be directed against

the corresponding ridge crests in accordance with the principles that we have already considered. From the buccal aspect, the cusp surfaces permit an arrangement whereby they may be placed parallel with the supporting ridge as demanded by good mechanics. The tooth form is exceptionally valuable in crossbite cases in which it has the advantages but not the disadvantages of anatomic forms. The mandibular tooth forms allow more tongue room and permit a retaining influence of the tongue on the mandibular denture. The mesiodistal relationships that are so troublesome in arranging anatomic forms are totally disregarded from a mechanical standpoint in arranging channel forms.

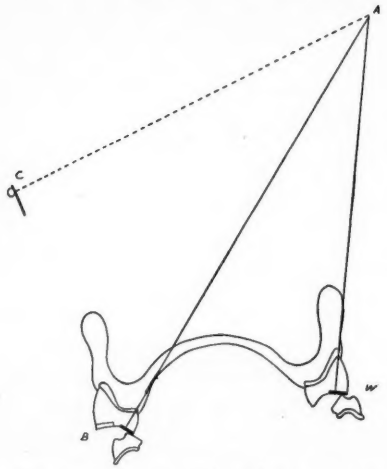


Fig. 16.—Lateral articulating center *A*. The perpendiculars from the tooth guidances on the working and balancing sides, and from the condyle guide of the balancing side meeting at a common point *A*, determine the lateral articulating center.

Since these teeth eliminate many problems in tooth articulation, they are highly recommended; and if they are used with the mechanical principles of tooth arrangement herein suggested, the results will be more definite and scientific than is possible with ordinary teeth

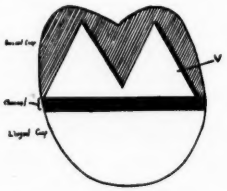

Fig. 17.—Maxillary channel posterior tooth, occlusal surface. Note V-shaped elevations on the occlusal surface of the buccal cusp. Note also the "channel" between the buccal and the lingual cusps.

Fig. 18.—Maxillary channel posterior tooth as seen from the buccal side.

Fig. 19.—Maxillary channel posterior tooth as seen from the mesial side. The "channel" between the buccal and the lingual cusps is plainly visible.

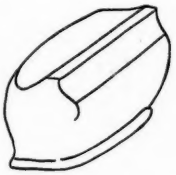

Fig. 20.—Mandibular channel posterior tooth showing continuous occlusal plateau to fit in channel of maxillary tooth.

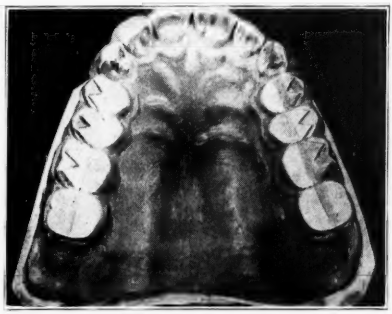

Fig. 21.—Maxillary denture showing channel posterior teeth. The "channel" is faintly visible.

and with the ordinary methods of tooth arrangement. Furthermore, the resulting restorations will be more stable and more comfortable in the mouths of our patients.

CONCLUSIONS

Sound mechanics demands that:

1. The forces of occlusion be at right angles to both ridges.
2. The ridges be parallel.
3. The guiding surfaces of the posterior teeth be parallel with both ridges as viewed from the buccal side.
4. The guiding surfaces of the posterior teeth be placed over the crests of the ridges.
5. Like occlusions be associated with like relations, and that there be continuous balanced occlusion throughout all jaw relations.
6. Tooth forms that permit of their arrangement in accordance with the

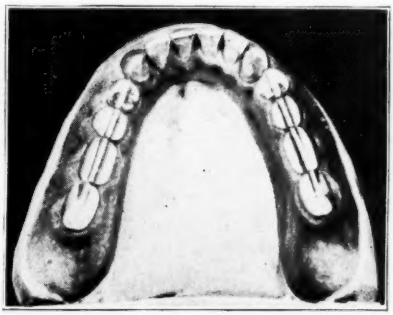

Fig. 22.—Mandibular denture, showing channel posterior teeth before milling. The occlusal plateau is sharpened to a point after milling.

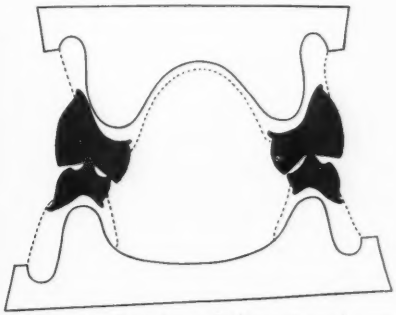

Fig. 23.—Centric occlusion, channel posterior teeth. Left: Before milling. The mandibular tooth plateau is set over the crest of the mandibular ridge. The plateau fills the maxillary tooth channel. The lingual ledge of the mandibular tooth makes contact with the lingual cusp of the maxillary tooth. The buccal cusps are not in contact. Right: After milling. The mandibular plateaus are sharpened to a crest which occludes with the center of the maxillary channels. There is no contact of buccal or lingual cusps, a limited lateral "free-play" in centric occlusion being thus allowed.

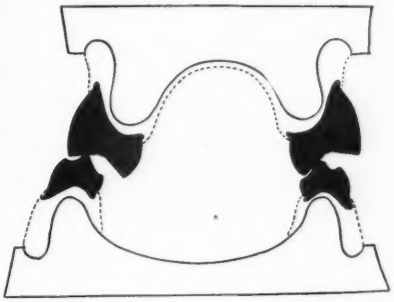

Fig. 24.—Channel posterior teeth in lateral balance after milling.

above stated fundamental mechanical principles.

7. Tooth forms be used that are mechanical in design, not anatomic, to meet the artificial conditions under which artificial dentures function.

8. The tooth forms have no projections on their cusps that lock into opposing depressions to prevent free protrusive movements.

9. Tooth forms be used that permit efficient mastication of food with the minimum of force.

10. There be a safety margin of lateral free play in centric occlusion.

11. Because of these requirements for full denture work, anatomic forms of posterior teeth be relegated to the past.

12. Of the several mechanical tooth forms now before the profession, the channel type of tooth is the only one that meets all of the demands of good mechanics and esthetics.

333 Fairmount Avenue.

# A BROADER VIEW OF THE GNATHOSTATIC DIAGNOSIS OF SIMON*

By NORMAN L. HILLYER, D.D.S., Brooklyn, N. Y.

DURING the past few years, the great need of an objective method of diagnosis of our cases has been more and more felt, talked about and written of. Ruppe,[1] Van Loon,[2] Tryfus,[3] Wüstrow,[4] Case,[5] Lischer,[6] Pfaff,[7] Stanton,[8] Schwarz,[9] Simon [10] and many others have turned to other ideas and to other methods of approach to the subject of proper diagnosis. Their methods, of course, are very different, some fundamentally so, but they all chose to employ them because they knew that the subjective approach was inadequate to their needs and the needs, as they saw them, of the profession at large. It is certainly extremely impractical and an unscientific waste to wait, as an inexperienced orthodontist must be content to do under the subjective method, until enough recognizable errors have convinced him that he is on the wrong path, at which time all sorts of goblins arise to disturb his mind.

*Read before the Section on Orthodontia at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

1. Ruppe: Le Laboratoire et les Progrés Dentaire, April, 1914.

2. Van Loon: Dent. Cosmos. Sept., Oct., Nov., 1915. Ztschr. f. Zahnärtzl. Orthop., 1916, pp. 1-4.

3. Tryfus: Diagnostic Problem in Dental Orthopedics—A Critical Consideration and Contribution.

4. Wüstrow: Possibility of Procuring Gnathostatic, Symmetroscopic and Photostatic Measurements with a Single Orthodontic Instrument, Ztschr. f. Zahnärtzl. Orthop., 1921, p. 22.

5. Case: Dental Orthopedia and Correction of Cleft Palate, Ed. 2, Chicago: Lakeside Press, 1921.

6. Lischer, B. E.: Orthodontics, Philadelphia: Lea and Febiger, 1912.

7. Pfaff: Text Book on Orthodontics, Ed. 2, Leipsic, 1921.

8. Stanton: Clinic Outlining Surveyor Technic, Rep. 1st Internat. Orthodon. Cong., 1926.

9. Schwarz: Cephlometric Methods and Orthodontia, Rep. 1st Internat. Orthodon. Cong., 1926.

10. Simon: Fundamental Principles of a Systematic Diagnosis of Dental Anomalies and the Norm-Concept in Orthodontia, Boston: Stratford Co., 1926. (Trans. by Lischer.)

and he becomes so lost in a maze of "dos" and "don'ts" that he cannot "see the forest for the trees."

It is the duty of the profession to find, by research, a method that will serve the orthodontists of the oncoming years. This can be best done by experimentation and research on the part of the orthodontists of today, with some gnathostatic or anthropologic fiction as a starting point. The end result toward which this research should progress would be a usable fictional norm which would apply objectively to the mixed population which makes up our practices.

Such a basis is the fiction of Simon, which, while admittedly not dependable as an infallible guide today in our work, is yet a usable fiction,[11] built upon scientific principles of gnathostatics, philosophy and anthropology.

Perhaps a discusison of a fiction as it is used in philosophy would be advisable. A fiction first is a psychical form[12] which must be usable and which differs from a hypothesis in that it presupposes no need of proof as a true fact. It must not be confused with a philosophic law, which is an observation of the uniform occurrence of natural phenomena in the same way or order, under the same conditions. The fiction then must be logical and useful, whether it subsequently becomes an accepted truth or is supplanted eventually when its usefulness is no longer manifest. Fiction is used and confused with fact in our daily life. To mention briefly a few such: Time is considered a constant fact, but may be and is regulated by law, usage or locality, to make it most useful to the greatest number of people. Color is seen differently by all of us, and may be very incorrectly though usefully realized by one who is color-blind. We say that the compass points north, and so it does for all useful intents and purposes in our latitude; but, at the North Pole, its needle will point exactly south owing to the relative positions of the north polar axis and the magnetic North Pole.

In medicine, many diseases are treated as if the cause of the disease were known and cures are affected regardless of the fictional character of the cause and the resultant therapy.

In our own science of dentistry, the fiction arises often, in the curve of Spee, the Bonwill triangle and the Monson sphere, and in many other useful conceptions or devices.

Many more fictions could be cited, but these will suffice to show that the fiction embodied in Simon's work is admissible if useful, as I hope to show to your satisfaction.

Dewey,[13] although an opponent of Simon's system as it is blindly followed by many men, advises strongly that further study and investigation be given it to prove or disprove its usefulness to orthodontia. This is an attitude so fair and so productive of scientific progress, no matter what its end-results, that it would do us all good to put away our laurel wreaths or our scalping knives and to follow out this sound advice.

It is realized that the points brought out by Simon have drawn and will continue to draw their measure of criticism. But all criticism should be constructive in the final analysis. It is the life of science and the safeguard of progress. It makes for breaking down of erroneous "facts," such as Angle's constancy of the upper first molars, and brings up new suppositions which may in turn be elab-

11. Pullen: J. A. D. A., 15:670 (April) 1928.

12. Vaihinger: Die Philosophie des Als-Ob, Leipsic: Menier, 1923.

13. Dewey, Martin: Disc. Stanton at the American Society of Orthodontists, Chicago, 1927.

orated into useful fictions. It is of course recognized that, as Schwarz[14] has pointed out, "measuring in itself alone is not enough to make a real orthodontist." It is easily observed also that this paper has purposely been kept in the field of generalities as much as possible, because its fictional background calls for no proof and because the material it is discussing has not as yet been investigated enough in this country to afford conclusions which would stand the test of discussion.

In analyzing the parts of a Simon diagnosis, the photostat seems to come first under notice. This has been very generally accepted by the profession at large, although many who endorse it are slow to use it and so to learn its full value. It is acknowledged to be simple to operate, low in actual cost of operation and accurate enough to be universally used.

The three planes upon which are based the three-dimensional measurements of the system probably need to be discussed more fully. The ear-eye plane, or the Frankfort horizontal, has long been accepted as an accurate and usable fiction by anthropologists. While it is true that its four points, two orbitalia and two tragia, seldom if ever fall on the one plane since the head is a biologic and not a geometric object, it is also true that, out of these four points, three will give us a sufficiently accurate geometric average to determine the ear-eye plane. In all geometry, three points are the necessary minimum to establish a plane. This plane is represented by the top of the upper model of the case.

The second, the raphé-median, is old in anthropology, but under the name of the median-sagittal plane. It is difficult in our limited dental and oral sphere to establish this plane as we must do on a living subject. The basion cannot be localized, and it is very difficult to place the inion, bregma or glabella, all of which are anthropologic points which may be used on skulls or wet specimens to establish this plane. The subnasion and the prosthion, although easy to locate and normally on the plane, are generally in a very involved area, in a case requiring our diagnosis and subsequent treatment. It therefore becomes necessary to use a compromise to place this plane in a useful and static position. This is logically acceptable since the palatine suture occupies the midline of measurement of bilateral symmetry, and as the growth of the two lateral halves of the palatine process proceeds from this line, and also since, because its calcification is complete at an early age (second embryonic month), it is not affected, except in its anterior end, by orthodontic interference undertaken between 6 and 12 years of age. Therefore, two points are chosen as far apart as possible, points which lie on the palatine suture as it is shown on the model but posterior to the cuspid region of the maxilla. This plane is at right angles to the ear-eye plane and so also to the top of the upper model. It extends through the lower model also by projected construction.

The third plane, the orbital, has come in for the greatest discussion and criticism by the profession and the entire system of Simon is often condemned because exception is taken to this one plane and its application. It has been rightly claimed that the orbitalia, upon which this plane is constructed, are inconstant. Simon claims that notwithstanding this indubitable fact, the plane is a useful fiction. The plane itself and its application to, or position on, the denture must not be further confused, as has happened

14. Schwarz: Rep. 1st Internat. Orthodon. Cong., p. 325.

to our sorrow in the past. Simon's contention that the plane, a useful fiction, can be applied to the teeth in the oral cavity, and when so applied to the types of patients under his observation, notably with German and allied characteristics, giving a norm which placed the plane on the cusp of the upper cuspids, is true and useful as far as it can be applied here and by us. This contention was unfortunately miscalled the "law of the canines," and has been assailed in terms running from incorrect[15] to variable.[16] Facts have been brought out by Hellman,[17] in his very carefully arranged and extremely scholarly way, which show that the facial bony growth is not symmetrical in any dimension, and therefore it seems logical that no plane can be applied to even the same face at various ages with the same results. This is discouraging, but to no greater degree perhaps than that which has been facing anthropologists for many years. But they, through constant research in biometric averages, have greatly surmounted these difficulties and have established usable norms. We should strive to do the same through extensive research with a view to establishing useful norms as standards of comparison for diagnosis and treatment.

Just what do these planes show to the orthodontist who wishes to use them for diagnosis or comparative observation? The planes are all represented by lines on the surfaces of the models, except the Frankfort horizontal, which is arbitrarily made on the top of the upper model. These lines are constructed with the gnathostat, the symmetroscope and the sliding compass, all of which are very exhaustively described in "Diagnosis of Dental Anomalies" by Simon, translated by Lischer.

From the ear-eye plane or the top of the upper model, the facial height index and its growth can be observed and measured. The curve of Spee is shown as it appears in the patient, and the idea of its steepness or its lateral tilt is instantly obtained. Open-bite cases are particularly well shown in this dimension, and a conception as to whether the upper or the lower anterior teeth are in need of elevation, or perhaps whether both arches are malposed, is very easily obtained. The inclination of the tooth axis is demonstrated and is often of the utmost use in diagnosis.

From the raphé-median plane, observation shows the presence or lack of transverse symmetry, and arch form is objectively demonstrated. The tooth axis inclination is obvious in yet another dimension than from the horizontal plane.

The orbital plane demonstrates sagittal symmetry or the lack of it in an anteroposterior direction and helps the eye to determine whether one side has drifted forward in our troublesome unilateral distoclusion cases, so-called. The degree of prognathism and the inclination of the tooth axis in the third dimension are points emphasized by comparison with this plane.

In short, these lines and surfaces representing planes in the head and on the dental area give the status quo with which the experienced orthodontist can diagnose each individual case with greater ease and can plan the necessary steps of treatment accordingly.

## CONCLUSION

1. There is great need for an objective aid to proper and satisfactory diagnosis of dental anomalies.

15. Connolly: Am. J. Phys. Anthropol., 1927.

16. Brandhorst: Photographic Exhibit, Rep. 1st Internat. Orthodon. Cong., p. 602.

17. Hellman, Milo: Rep. 1st Internat. Orthodon. Cong., p. 118.

2. The diagnostic system of Simon in its present form is a very useful fiction and a sound basis for research and study to the end that a biometric average or norm can be obtained for use in the diagnosis of the malformation of the jaws of our racially polyglot people.

142 Joralemon Street.

DISCUSSION

*O. W. Brandhorst, St. Louis, Mo.:* I wish to commend to you an earnest investigation and study of gnathostatics. Those of us who have dealt with this subject in some form realize that there are some things that were not clear at first. We now find that it all has a great value in diagnosis. There are certain things in regard to racial characteristics that can be brought out by this method, but just where we are going to arrive in that respect in dealing with our mixed racial types here in the United States is yet a question. I have found, in trying to check some Negro skulls, some of which were classified as full-blooded, while others were graded down to three-quarters, one-half and one-quarter, that there is a rather definite line of gradation in these various types, based, of course, on the average for the group. I hope some day to present something showing how the orbital plane, on the average, gradually moves forward with the black and white mixture, being farthest back in the full-blooded black, and moving forward as the percentage of white blood increases. This is obvious; for we all know that the Negro is a prognathic type. To what extent we can apply such information at this time is a question. We know too that the orbital plane varies materially in the cases we have, and yet this need not deter us from applying it in the broader sense as Dr. Hillyer has outlined.

*Dr. Hillyer (closing):* Dr. Brandhorst has done more to further the cause of the scientific Simon diagnosis by criticizing it scientifically and open-mindedly than anybody in the country. A short while ago he gave a paper which started me on my present line of thought, on the variations shown by photostatic photos; variation in patients with so-called normal dentures, which showed such a marked divergence in the position of the orbital plane on the models as projected on the photos, that it opened my eyes for the first time to the great possibility of variation within the limits of "normal occlusion."

# PROBLEMS OF OCCLUSION IN PARTIAL DENTURE CONSTRUCTION*

By VICTOR H. SEARS, D.D.S., New York City

PARTIAL denture restorations were once regarded as contrivances to tide the patient over while the remaining natural teeth limped along toward inevitable demise. That day is passing. The day is also passing when partial dentures are so lightly considered that they may be made by arbitrary methods. We have been advised to arrange occlusal surfaces according to average and arbitrary articulator movements and this advice has been quite willingly followed by many of us in the past. But let us turn our attention to the future.

As the erection of a great bridge over a river requires that the engineer solve numerous special problems before the structure itself can be intelligently planned, so does the making of a partial denture require certain preliminary calculations by the dentist before he can decide on any suitable design.

*Read before the Section on Full Denture Prosthesis at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 8, 1929.

At the present time, it would seem that there are usually at least eight preliminary steps to be taken before the dentist attacks the problem of designing a partial restoration. They are, in order: making of roentgenograms, making of casts, face-bow mounting, jaw separation, taking of the centric relation, condylar guide adjustment, incisal guide adjustment, and altering of the natural teeth. These steps will be given some consideration here, but their more complete development will be left to the bibliography cited throughout the text and appended to this manuscript.

While a partial denture restoration may correctly mean any type of appliance which restores a single tooth (either fixed or otherwise), in this discussion it will mean a removable bilateral appliance which restores several missing teeth.

Except for the making of the casts, and with the possible exception of the face-bow mounting, the eight factors all bear on the problems of occlusion, a statement which will be developed presently. Let us consider these preliminary factors in greater detail.

### ROENTGENOGRAMS

Partial dentures often cannot be intelligently planned without a knowledge of the tooth roots and investing tissues, as disclosed by roentgenograms. In order to apportion the load properly and to direct favorably the forces of mastication, it is necessary to have a clear conception of the relative supporting value of all the tissues involved—the number, size, shape and inclination of the roots as well as the density of the investing tissues and the condition of the peridental support. The roentgenogram is, at present, our best means of judging the stamina of those osseous structures which are to support tooth roots and saddles.[1]

### CASTS

Study casts should be as accurate as master casts. In fact, the first casts may often be employed as final ones. In any event, the study casts must be of such accuracy that the occlusal surfaces as well as the axial surfaces are faithfully reproduced. Inaccurate reproduction of the occlusal surfaces would make dependable adjustment of the articulator impossible. It would becloud the study of the present and proposed tooth guidances, and it would make the placing of occlusal rests haphazard. Inaccurate reproduction of the axial surfaces would make intelligent alining of crown portions and the rational placing of clasps impossible.

### FACE-BOW MOUNTING

While a face-bow may not be absolutely essential to partial denture prosthesis, it is of great convenience, especially in those numerous cases in which the degree of jaw separation is altered. The advantages here are the same as those in full denture construction.[2]

### JAW SEPARATION

Increasing the degree of jaw separation or "opening the bite"[3] has caused much havoc, both when dentures have

1. Jackson, H. H.: Edentulous and Semi-Edentulous Ridge from Radiographic Point of View, J. A. D. A., 14:1171 (July) 1927.

2. Needles, J. W.: Balanced Occlusion and and Relation to Partial Denture Construction, J. A. D. A., 11:820 (Sept.) 1924.

3. Doxtater, L. W.: Methods of Securing Full or Partial Functional Occlusion, Dent. Items Int., 50:281 (April) 1928. Monson, G. S.: Impaired Function as Result of Closed Bite, J. A. D. A., 8:833 (Oct.) 1921. Sears, V. H.: History and Technique of Occlusion, Los Angeles County Dent. Soc. Bull., February, 1925.

been built in malocclusion and when the crown portions of the teeth have been built higher than the roots would tolerate. Nevertheless, there are comparatively few mouths in which it is unsafe to increase the degree of jaw separation if the problems of occlusion are dealt with intelligently.

Imagine a tooth on which the highest point of the occlusal surface lies 4 mm. above the line of osseous support. If we double the height of the crown portion by making its occlusal surface 8 mm. above the support, we double the leverage and endanger the investing tissues. There are two principle means of minimizing the destructive horizontal forces incident to increasing the height of the crown: We may reduce or remove all cusps or prominences which could interfere with opposing occlusal surfaces during protrusive or lateral jaw movements; or we may brace the tooth or teeth so that the horizontal forces will be distributed to other parts of the same dental arch; both of which will be considered under separate headings. Even with the entire denture balanced in all functional jaw relations at a given degree of jaw separation and with the anchoring units well braced for mutual support, the utility of the involved roots as indicated by their number, size, shape and location, the inclination of their long axes and the integrity of their investing tissues, must be evaluated. The supporting value of the saddle-carrying tissues must also be included in the calculation.[4] It thus becomes evident that, in all but the most favorable cases, increasing the degree of jaw separation within the limits of safety is predicated upon the stabilizing effect of tying together the individual natural teeth.

### CENTRIC RELATION

There is still a disagreement among the authorities as to where the mandible should function in its relation to the maxillae.[5] Perhaps it would be uncharitable to say that those who prefer the "easy" position to that of true centric relation are merely seeking an "easy" way out. However that may be, there is an increasing number of careful practitioners striving to construct their restorations to centric jaw relations.[6] The mandible is in centric relation when in its most retruded rest postion from which lateral movement can be made.

A more exact definition is as follows: Centric jaw relation is the most retruded relation of the mandible to the maxillae, at a given degree of jaw separation, from which the patient (entirely by means of his own muscular control) can make mandibular movements to the right and to the left sides in even paths.

While it is undeniable that some patients prefer to bring their jaws to rest in eccentric positions, no valid reason has been forthcoming to explain why a jaw should be prevented from functioning safely in centric relation. Regardless of the jaw position in which the patient has been accustomed to chew, and regardless of the jaw position which the dentist may select, there is always a tendency for the mandible to settle into its true centric relation. It is a fortunate circumstance that when the restoration is balanced in centric relation according to well estab-

4. Footnote 1. Wright, W. H.: Importance of Tissue Changes Under Artificial Dentures, J. A. D. A., 16:1027 (June) 1929.

5. Elphinstone, I. L.: Artificial Dentures and Changeable Bite, Dent. Cosmos, 71:781 (Aug.) 1929.

6. Wright, W. H.: Anatomic Influences on Establishment of Balanced Jaw Relations and Changeable Bite, Dent. Cosmos, 71:781 (June) 1928.

lished standards,[7] the "easy" position as well as the other eccentric positions will, perforce, be in balance. If, on the other hand, some eccentric position is chosen to start with, unbalanced occlusion in other eccentric positions will frequently result as well, even as in true centric relation.

Whenever prosthetic dentures, full or partial, are so constructed that they do not balance in the jaw relation in which the patient ends the masticating stroke, there is grave danger of injury to the supporting tissues. Even when the dentures are balanced, whenever the patient chooses to end the masticating stroke either anteriorly or posteriorly of centric occlusion, the danger of trauma increases in direct proportion to the cusp height of the teeth. Centric occlusion is that relative contact position of opposing masticatory surfaces to which all other types of occlusion are referred. (Cusp height will be mentioned again presently, but at this time it is well to point out the danger of allowing a patient to do his chewing in any jaw relation inconsistent with the centric occlusion of the teeth.)

If a restoration has been constructed to a protruded jaw relation and if the opposing teeth interlock,[8] there will, in function, be an anterior thrust on the lower teeth and a corresponding posterior thrust on the upper teeth. This points to the necessity for accurately recording centric relation before beginning construction.

But it has been contended that centric relation is not fixed — that it may vary from time to time. This seems to be true, particularly in those cases in which the degree of jaw separation has been changed, but this fact should in no wise serve as an excuse for failing to record accurately in every instance the centric jaw relation. There are some who claim the ability to foreknow in which direction and to what extent this relation will change. Unless one is quite certain of his ability along this line, it is safer to provide for the expected change by means of suitable cusp forms rather than by attempting to determine the relation according to inspiration. Even when one attempts to predict a future condition, he can best do so with a knowledge of the present to which the future is related, and so, in order to predict a possible future jaw relation, the scientific dentist will record the centric relation which exists when the restoration is made.

### CONDYLAR GUIDE ADJUSTMENTS

In order to build satisfactory occlusal restorations, the cusp planes cannot be arranged in an arbitrary fashion. It should be clearly comprehended that the problems of occlusion in partial denture construction can be successfully solved only with a consideration of individual jaw movements; which logically means that the condylar elements of the articulator must be adjusted to meet the conditions of the individual patient.[9]

7. Doxtater, L. W.: Relation of Balancing Occlusion to Other Steps in Construction of Removable Bridgework, J. A. D. A., 15:482 (March) 1928. Hanau, R. L.: Relation Between Mechanical and Anatomical Articulation, ibid., 10:776 (Aug.) 1923; Articulation Defined, Analyzed and Formulated, ibid., 13:694 (Dec.) 1926. Footnote 2. Sears, V. H.: Full Denture Procedure, New York: The Macmillan Company, 1929.

8. Sears, V. H.: Some Fundamental Factors in Tooth Articulation, J. Dent. Res., 8:339 (June) 1928.

9. Sears, V. H.: Requirements of Articulators in Dentistry, Dent. Items Int., 48:685 (Sept.) 1926. Jaw Relations and Means of Recording Most Important Articulator Adjustment, Dent. Cosmos, 68:1047 (Nov.) 1926.

### INCISAL GUIDE ADJUSTMENTS

With the condylar guides adjusted according to the patient's jaw movements, there often remains considerable latitude in the adjustment of the incisal guide. At the same time, the adjustments must not be arbitrarily made. The incisal guide should be adjusted in harmony with the condylar guides and with the cusp angles of the proposed occlusal surfaces.[10] When the degree of jaw separation is not to be increased, the cusp guidances of the natural teeth (suitably altered if necessary), plus the condylar guidances, will determine the incisal guide adjustments. If the supporting units, when tied together by means of the proposed restoration, are considered able to bear comparatively great horizontal forces, it may be permissible to plan on high cusp angles and to adjust the incisal guide accordingly. If it is decided that the estimated horizontal forces will result in trauma,[11] it will be safer to adjust the guide to harmonize with the guidance of teeth having flatter cusps.

### ALTERING THE NATURAL TEETH

When the remaining natural teeth have prominent cusps and when the partial dentures are to be constructed without an increase in the degree of jaw separation, it becomes necessary to reduce the cusp angles of these teeth as a conservative measure.[12] The very loss of teeth in cases of this kind is presumptive evidence that the closing forces of the jaw on the steep cusp inclines caused more horizontal pressure than the peridental tissues were capable of withstanding. When cusp trauma has presumably already destroyed some of the teeth and endangered others,[13] it would be unwise to subject the remaining teeth to the additional load of restored teeth unless the destructive horizontal forces were greatly reduced.

On the assumption that the partial denture will serve a long period of usefulness, it is consistent to build up with jacket crowns or otherwise certain teeth which may, or may not, enter into the appliance proper. It is also good practice to cut away certain portions of teeth which would make too difficult or hazardous the insertion or removal of the restoration.[14]

The natural teeth may, at times, be advantageously altered in position as well as in form. Simple orthodontic treatment will sometimes bring a tooth into a more favorable position. In this connection, it is well to remember that most of the peridental fibers are arranged to withstand occlusal forces parallel with the long axis of the tooth. For this reason, as well as for the reason that tilted teeth are subjected to leverage,[15] the supporting value of a leaning tooth against occlusal forces is impaired, even though it may offer no difficulties in design or in insertion.

All operations on teeth, together with the extraction of those teeth which can-

10. Footnote 7, fourth reference.

11. Grove, C. J.: Trauma Produced by Occlusion Due to Horizontal Stress, J. A. D. A., 11:813 (Sept.) 1924.

12. Footnote 7, first reference. Doxtater, L. W.: Occlusion, Dent. Items Int., 50:211 (March) 1928. Footnote 11.

13. Bricker, F. A.: Diagnosis and Correction of Traumatic Occlusion, J. A. D. A., 11:697 (Aug.) 1924. Clapp, G. W.: Prosthetic Articulation, New York: Dentists' Supply Co., 1914, pp. 127, 130.

14. Schuyler, C. H.: Partial Denture Design with Special Reference to Maintaining Functional Occlusion, Dent. Items Int., 50:463 (June) 1928.

15. Orban, Balint: Tissue Changes in Traumatic Occlusion, J. A. D. A., 15:2090 (Nov.) 1928.

not be sufficiently reduced to prevent interference, and all peridental and other problems should be disposed of before the final impression is made.

### SADDLES

While the amount of closing force which can be safely exerted upon an alveolar ridge depends in large measure on the area covered and on the supporting value of the ridge tissues, the problems of occlusion here may be lightly passed over for the reason that the general aim should be to cover as much as possible of the usable supporting ridge, regardless of the number of teeth to be restored. To bear the forces of occlusion, the saddles should be physiologically adapted to the ridge,[16] and with full regard to the conditions revealed by roentgenograms, as well as in the light of all of the factors mentioned, these forces should be so controlled that the supporting tissues will be stimulated but not traumatized. It is well to contemplate that every saddle area may, at some future time, form a part of the basal seat of a full prosthetic denture.

### RETAINERS

It should be the aim to place retainers (clasps) on the teeth best able to bear the load. A tooth having large occlusal contact areas, and consequently subjected to great pressure toward the root, should not be subjected to great forces away from the root such as a retainer might exert.

It may be thought that a well-made retainer does not imperil the tooth to which it clings, but it is a matter that deserves consideration, especially in maxillary restorations. Even though there is no snap[17] as the denture is placed into position, there is the almost constant pull of gravity in a direction nature did not provide for, to say nothing of the additional pull in the same direction during the removal of the restoration. While the use of indirect retainers as advocated by Cummer is to be heartily endorsed, the fact must not be overlooked that they increase the pull on teeth carrying direct retainers. Occlusion on such teeth, which are ever so slightly elongated, becomes serious in direct proportion to the amount of elongation and to the weakened condition of the root-supporting tissues. This should lead one to consider multiple retainers in maxillary restorations of any considerable weight.

### RESTS

Rests are intended to prevent the settling of saddles with the consequent premature contact of the natural teeth. They also reduce the pressure on some parts (usually saddle areas) by directing a portion of the closing force on the teeth carrying the rests. It inevitably follows that the forces of occlusion are increased on the teeth carrying the rests, and for this reason teeth for this office must be chosen with discretion. Increasing the number of rests will reduce the amount of occlusal force to each tooth.

Occlusal rests are conveniently placed in conjunction with retainers, but rests and retainers are separate devices serving different purposes and should be employed strictly in accordance with their respective functions. For example, in supplying two missing molars, it may be advantageous to place a retainer on the second bicuspid without a rest on this tooth, placing the rest on the first bicus-

16. Phillips, G. P.: Physiological Basing of Lower Partial Dentures, Dent. Forum, 2:9 (July) 1927.

17. Nesbett, N. B.: Partial Dentures or Orthodontic Appliances, Ney Technician, 1926.

pid. Such construction serves to prolong the life of a crippled second bicuspid without detriment to other parts.

### CONNECTERS

Those parts of a restoration which connect the various units should be rigid in proportion to the necessity for tying together for mutual support the saddles, retainers and rests. The so-called "stress-breakers" should be used in great moderation for the reason that whatever stress is removed from one part will unavoidably be applied at some other place. While it is undeniable that "stress-breakers" can, under certain conditions, be made to prolong the usefulness of teeth carrying the retainers, we must not lose sight of the fact that teeth are sometimes thus shielded at the expense of alveolar tissue which might otherwise retain its health and supporting value, and which may at some future time be vitally important. Tissues underlying saddle areas have been too frequently sacrificed in order to conserve teeth which later have had to be removed.

It is also a matter of serious reflection that "stress-breakers" cannot be too greatly relied on to be of value to the very teeth which they are intended to save. Poorly invested teeth which, standing alone, would be unable to tolerate the horizontal forces incident to function could be safely subjected to these forces provided they are supported by rigid connecters instead of being attached to the restoration by "stress-breakers." In proportion to the flexibility of the "stress-breaker" is the body of the restoration prevented from stabilizing the tooth on which stress is broken. The relation is reciprocal: in proportion as the retaining tooth limits the movement of the restoration, so does the restoration limit the movement of the tooth. The value of the entire denture in minimizing the horizontal forces of the teeth in question depends largely on the rigidity of the appliance and on the horizontal supporting value of the other teeth and saddle areas.

Rigid connecters also reduce the vertical forces on a given tooth by distributing these forces to other supporting units. Of course, this distribution of vertical forces on supporting teeth and saddle areas depends on occlusal rests or their equivalents.[18]

The scheme of tying teeth together by means of a rigid restoration, for the purpose of apportioning the load, meets with opposition by some advocates of "individual tooth movements."[19] It should be comforting to this group to be told that the amount of movement of a tooth root in its socket can be controlled, within wide limits, by the character of the appliance. At the same time, the fact should be emphasized that, in a thorough consideration of the problems of occlusion in partial denture construction, we are more deeply concerned with preventing this mobility than we are in permitting it, and the fewer and weaker the individual teeth, the greater their need of support. Clinical experience seems to indicate that partial dentures serve a longer period of usefulness when the heavily burdened natural teeth are stabilized by means of rigid connecters.

There is, of course, a possibility, in some cases, of carrying this stabilization to extremes. A tooth completely immobilized in its socket, and thus denied

18. Tinker, E. T.: Partial Gold Saddle Cases and Clasp Attachments, J. A. D. A., 16:664 (April) 1929.

19. Chayes, H. E. S.: What Constitutes an Ideal Partial Denture, J. A. D. A., 16:902 (May) 1929. Diamond, Moses: Bridgework: A Consideration of Its Principles and Uses, J. Dent. Res., 8:635 (Dec.) 1928.

the usual stimulation, is certainly not functioning as provided for by nature. The point which seems to be overlooked is that teeth should be permitted some movement in their sockets, but at the same time should be prevented from excessive mobility, and this regardless of whether they move individually or in unison. Even though the character of a tooth's mobility is somewhat modified by the restraining influence of the restoration, it is better to control the movements within safe limits than to permit any excessive freedom. Much of the condemnation visited on rigid restorations of all kinds has been misdirected against the tying together of supporting units, when the objection should have been leveled against a condition of malocclusion or too great prominence of cusps.

### ARTIFICIAL TEETH

As in the case of natural teeth already mentioned, in artificial teeth the vertical forces are in direct proportion to the occlusal area involved. Vertical forces are reduced by decreasing the buccolingual or mesiodistal dimensions of the occlusal areas, by spacing the teeth or by rounding the angles. They are also decreased by eliminating the boxlike "food traps" found on natural cusp forms.[20]

Horizontal forces are reduced by eliminating any cusps or projections which could interfere with opposing occlusal surfaces during any of the functional jaw movements, and by making the artificial cusp guidance no steeper than the natural one.

As pointed out in discussing centric jaw relation, any restrusion or protrusion of opposing teeth carrying mesial and distal inclined planes in occlusion must result in anterior or posterior thrusts on the teeth. Excessive mesial and distal forces, as well as buccal and lingual ones,[11] are to be minimized by a reduction in the cusp angles of the teeth, both natural and artificial. In accordance with the contention previously made,[21] artificial teeth should be designed to meet the peculiarities of the individual case, as the problems of occlusion are to be solved largely by the use of suitably formed surfaces.

### OCCLUSION PROPER

Aside from the differences indicated in the discussion of the foregoing factors, the problems of occlusion in partial denture construction are essentially the same as those in the full denture field. The literature on this subject is so replete[22] that elaboration here would be largely repetitious.

One essential difference between full and partial restorations is that whereas, in the former, the cusps at the extremes of the denture are made to break contact on the working side [23] (in order to minimize occlusal pressure at the denture extremes), in the latter, the occlusal pressure on any tooth may be similarly reduced by the same device of decreasing the comparative angle of its buccal cusp, thus disengaging it in the working position.

Another difference between full and

20. Footnote 12, second reference. Sears, V. H.: Channel Type Posterior Tooth Forms, J. A. D. A., 15:1111 (June) 1928.

21. Footnote 20, second reference. Footnote 8.

22. Footnote 11, second reference. French, F. A.: Cusp Trauma, J. A. D. A., 11:792 (Sept.) 1924. Footnote 7, second and third references. Schwartz, M. M.: Important Considerations in Tooth Arrangement, J. A. D. A., 16:820 (April) 1929. Sears, V. H.: Balanced Occlusion, J. A. D. A., 12:1448 (Dec.) 1925. Footnote 20, second reference. Footnote 8. Footnote 7, fifth reference. Footnote 6.

23. Footnote 20, second reference.

partial restorations is that after obtaining satisfactory occlusion, the problem of maintaining an optimum condition must be differently provided for. Whereas in full prosthetic restorations all of the teeth are removable for the purpose of occlusal adjustments, in partial restorations only the restored ones are thus removable. Settling is also different in character.[24] It is therefore obvious that in partial prosthesis, special provision for anticipated changes should be made according to the peculiarities of the case in hand.[25] Even with the most farsighted precautions, the patient should be recalled at intervals for examination of the restoration and of its supporting tissues. The need for rebasing saddle areas and altering occlusal surfaces may be thus discovered.

## CONCLUSION

In all but the most simple cases, the complexity of the problem and the many fine discriminations necessary in the sequence of steps should point forcibly to the rashness on the part of many dentists of furnishing merely an impression and a "bite" to a dental laboratory with the expectation of receiving in return a restoration worthy of a place in a human mouth. Although the actual construction of the most intricate appliance may be delegated to a skilled technician, the problems of occlusion (to say nothing of the other problems) cannot be satisfactorily solved without an intelligent consideration of the factors enumerated. The dentist is the only person in a position to comprehend these factors and it is he who should design the restorations in order to insure control of the various phases—including those which pertain to occlusion.

24. Footnote 7, second reference. Stansbery, C. J.: Tissue Changes Under Dentures, J. A. D. A., 16:349 (Feb.) 1929. Footnote 4, second reference.

25. Monson, G. S.: Occlusion as Applied to Crown and Bridgework, J. N. D .A., 7:399 (May) 1920. Footnote 2.

## DISCUSSION

*J. Lowe Young, New York City:* It is a pleasure to discuss an essay by one who is courteous enough to submit a copy in time so that due consideration can be given the subject. In my opinion, the great object in having discussions of papers presented is to safeguard our published material and not permit unchallenged extravagant statements to come under the eyes of our younger practitioners. They are the ones who should carefully study the literature if they ever hope to advance. An author should never take umbrage at adverse criticism. He should either be willing to stand corrected or be prepared to elucidate his statements at least to the majority of his audience, if not to his critic. In this paper, the author has so clearly and concisely expressed himself that there can be no misunderstanding his meaning. There is exceedingly little with which I can take exception, and much to commend. On page 3, Dr. Sears says: "Imagine a tooth on which the highest point of the occlusal surface lies 4 mm. above the line of osseous support. If we double the height of the crown portion by making its occlusal surface 8 mm. above the support, we double the leverage and endanger the investing tissues." This is not absolutely true, if I correctly understand his meaning. If we are to understand that the lower border of the alveolar process is the line he has mentioned, and the length of the crown is increased as stated, the leverage would not be doubled, for it becomes necessary to determine the central point of resistance of the tooth in question. It is well for us to keep in mind that the author has confined his remarks to removable bilateral appliances which restore several missing teeth, and not to full denture construction. Owing to this fact, it would seem that the term "functional occlusion" is decidedly preferable to "balanced occlusion," the latter term being best confined to full denture prosthesis. The reason for this is that we do not find normal dentures in balanced occlusion in civilized races in 1 per cent of cases examined. In using the term "normal human dentures," we are only referring to those cases that develop without any mechanical stimulation. "The natural

teeth may, at times, be advantageously altered in position as well as in form. Simple orthodontic treatment will sometimes bring a tooth into a more favorable position. In this connection, it is well to remember that most of the peridental fibers are arranged to withstand occlusal forces parallel with the long axis of the tooth. For this reason, as well as for the reason that tilted teeth are subjected to leverage, the supporting value of a leaning tooth against occlusal forces is impaired, even though it may offer no difficulties in design or in insertion." Unfortunately, it is not always so simple to restore normal cusp relation of mutilated cases. Orthodontic treatment of adults is always trying to both patient and operator. This is largely due to the fact that the older we are, the more set we become in our ways and the less tolerant we are to inconveniences. There is no age limit for moving teeth, but the older the patient, the more delicate should be the force applied. We must remember that without reformation of bone about the roots or root of a tooth placed in functional occlusion, we have not benefited the patient. The secret of successful treatment of adult cases is that the appliances should be so devised that continuous delicate pressure in the proper direction is obtained. Obviously, such cases cannot be successfully treated in a few months. Furthermore, it is not permissible that the permanent restoration (if there is such) be constructed as soon as the orthodontic appliances are removed. A removable retainer, supplying the missing teeth, so constructed that the permanent teeth may properly settle, should be worn for at least six months. The loss of the mandibular first permanent molars, particularly in early life, is responsible for greater interference with function than any other one cause. When a mandibular first permanent molar is removed, the second molar tips forward, drifts lingually and rotates in 99.9 per cent of cases. I found only one case in which the loss of such a tooth has not tremendously interfered with mastication. It is therefore imperative that either the lost tooth or teeth be supplied as early in life as possible, or that proper orthodontic measures be taken to carry the mandibular second molars forward into proper position. The loss of other permanent teeth interferes with function in proportion to their importance in the dental mechanism and obviously should be properly supplied. If all partial restorations were as carefully planned as outlined by Dr. Sears, and properly constructed, the end result, from the standpoint of mastication, would be better served by supplying the lost organs, in the vast majority of cases.

*Dr. Sears (closing):* The objection Dr. Young made to the height of the crown being doubled, from 4 to 8 mm., is mathematically sound. I did not intend to complicate the issue. I merely meant to bring out the point that increasing of the crown portion would increase the leverage on the tooth proportionately. With regard to functional occlusion with relation to balanced occlusion, my feeling is that as there is nothing to lose in the average case in establishing balanced occlusion for partial dentures, there can be no objection to obtaining it. I feel also that Dr. Young would not object to balancing the occlusion provided no other factor were entering into it. This recommendation should be applied with due consideration to all of the other factors involved, weighing the debit and credit. One other thing, about "simple" orthodontic treatment: It was far from my intention to infer orthodontia was so simple. That word "simple" should not have been in the manuscript.

# AN APPARENT SHORTENING OF AN UPPER INCISOR: ITS SIGNIFICANCE*

By WARREN WILLMAN, B.S., D.D.S., Chicago, Ill.

A BOY of 14 came in with the complaint that the upper left central incisor was steadily becoming shorter. An examination disclosed a porcelain crown approximately 2 mm. shorter than the adjacent central incisor, and the history stated that it had been of the same length when placed, two years previously. An accident during a baseball game was the occasion of the restoration. The mesial corner of the right central and presumably some considerable portion of the crown of the left central incisor were broken off. The dentist placed a root-canal filling in the left central incisor and supplied it with a porcelain crown. The right central was left untouched and, at the time of observation, secondary decay had caused the death of the pulp.

Roentgenograms were taken which showed extensive resorption of the sides of the root of the apparently shortened left central incisor, the apex remaining intact. The explanation of this condiiton lies in the fact that bone replaced this resorbed tooth structure without the production of a periodontal membrane, the root being virtually ankylosed to the alveolar process; and so, with this tooth anchored as a guidepost, the remaining denture continued to erupt, the apparently shortening tooth being left behind. As the permanent teeth are normally in occlusion at the age of 12, this incident furnishes one of the clinical proofs of the concept of continuous eruption of human teeth.

This concept was first advanced by Gottlieb of Vienna in 1921 in connection with his discovery of the migratory nature of the epithelial attachment. He found, at that time, that human teeth do not stop erupting when they come into occlusion with their antagonists but that the rate of eruption is merely changed; also, that their eruption is twofold: out of the mandible and maxilla toward the occlusal line, and into the oral cavity by virtue of the rootward migration of the epithelial attachment. Ordinarily, these two processes occur simultaneously, and the more slowly they proceed, the more favorable is the prognosis of long life for the denture. Every practitioner sees older persons whose teeth are free from calcific deposits, so that no marginal irritation exists, yet with a considerable amount of cementum visible, forming part of the clinical crowns of the teeth.

If these teeth are well abraded to compensate for this eruption, the clinical crowns are not materially different in length from what they were when they

*Read before the Chicago Branch of the International Association for Dental Research, Dec. 16, 1929.

*From the Research Department (Director, Rudolf Kronfeld) of the Chicago College of Dental Surgery, Dental Department of Loyola University.

came into occlusion in youth. If they are not sufficiently abraded, they become excessively long and, by the abnormal leverage that they thus can exert on the remaining periodontium, may easily become loosened. On the other hand, if abrasion is excessive and eruption too slow, the clinical crowns become unnaturally short. Ideally, the two processes, abrasion and eruption, should compensate for each other, to maintain an approximately uniform length of crown.

Either aspect of the phenomenon of eruption—the addition of tooth surface to the clinical crown by downward growth of the epithelial attachment or the migration of the tooth itself toward the occlusal line—can occur quite independently on occasion. The lingual root of an upper molar or the labial surface of the root of a cuspid is frequently exposed to view without this tooth moving more rapidly than the others toward the occlusal line. On the other hand, single teeth or groups of teeth, or even the entire denture, may erupt toward the occlusal line without the epithelial attachment migrating far enough to make the crowns of the teeth appreciably longer, and it is in this connection that our present specimen is valuable. In this case, the entire denture, or certainly at least the upper denture, had erupted during two years to the extent that the anterior teeth are now about 2 mm. farther from the floor of the nasal fossa.

Microscopically, this has been demonstrated by the presence of epithelial rests in the channel through which the blood vessels and nerves reach the pulp and by the presence of bundle bone deposited in the apical region.[1] Clinically, however, the eruption of teeth out of the mandible and maxilla toward the occlusal line has been difficult to demonstrate because of the lack of a fixed point for a guide. In our case, the upper central incisor being literally locked in place by the ingrowths of bone on its sides necessarily stayed in the same position relative to the maxilla

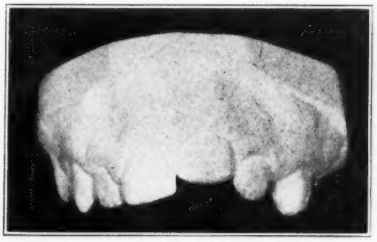

Fig. 1.—Plaster cast of the upper anterior teeth, showing the upper left central incisor to be approximately 2 mm. shorter than the right.

Fig. 2.—Right and left upper central incisors. The pulp canal of the left incisor is filled to the apex. The natural crown is replaced by an all-porcelain dowel crown. Deep resorption in the middle third of the root can be seen, with bone replacing the resorbed tooth structure. The right incisor shows an area of resorption around the apex. It will be noted that there is the same distance between the levels of the ends of the roots as there is between the incisal ends of the two teeth, which shows that the entire left incisor is located nearer the nasal cavity than is the other tooth.

1. Orban, Balint: Dental Histology and Embryology, Ed. 2, Philadelphia: P. Blakiston's Son and Co., pp. 166-167.

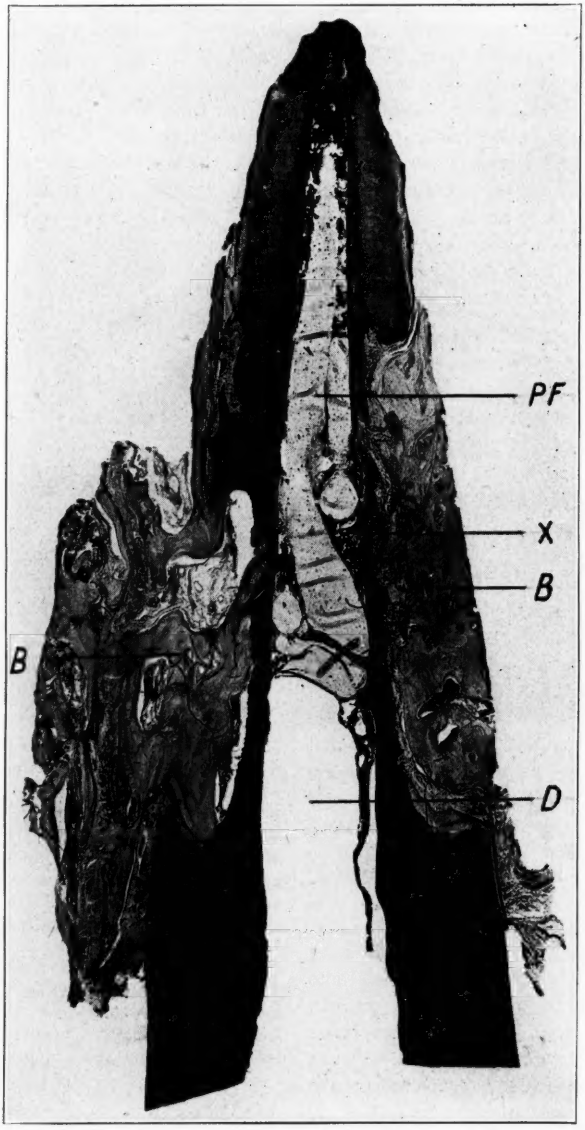


Fig. 3.—Mesiodistal section of the upper left central incisor, showing the large areas of resorption, with replacement by bone. *B*, bone. *D*, space formerly occupied by the dowel supporting the porcelain crown. *PF*, pulp canal filling. (×9.)

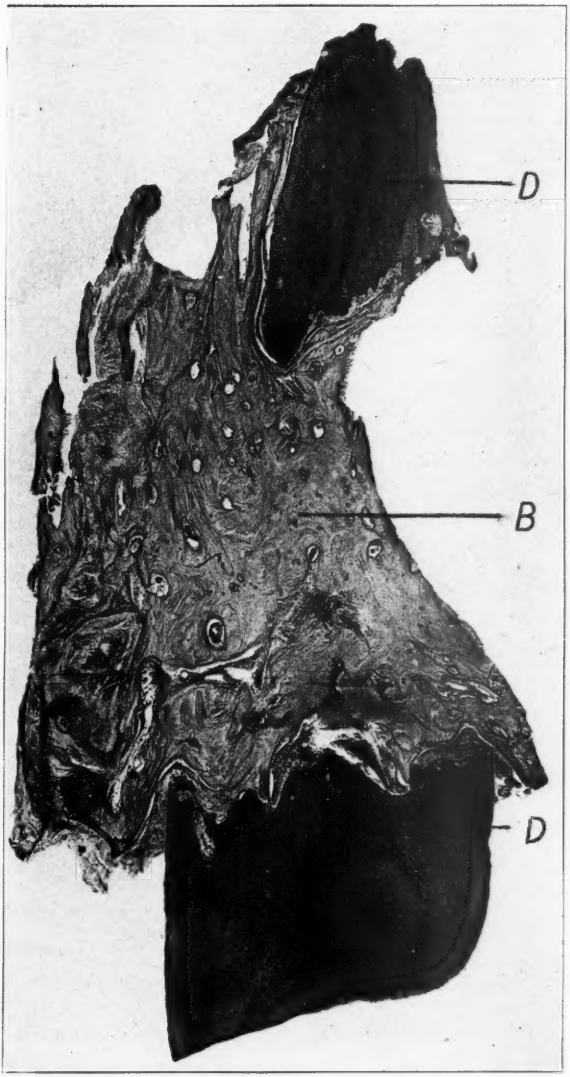


**Fig. 4.—Tangential section of the specimen shown in Figure 3, taken nearer the labial surface. The continuity of the root structure is broken by the deposition of bone, which may be seen in direct contact with the dentin. *B*, bone. *D*, dentin. (×9.)**

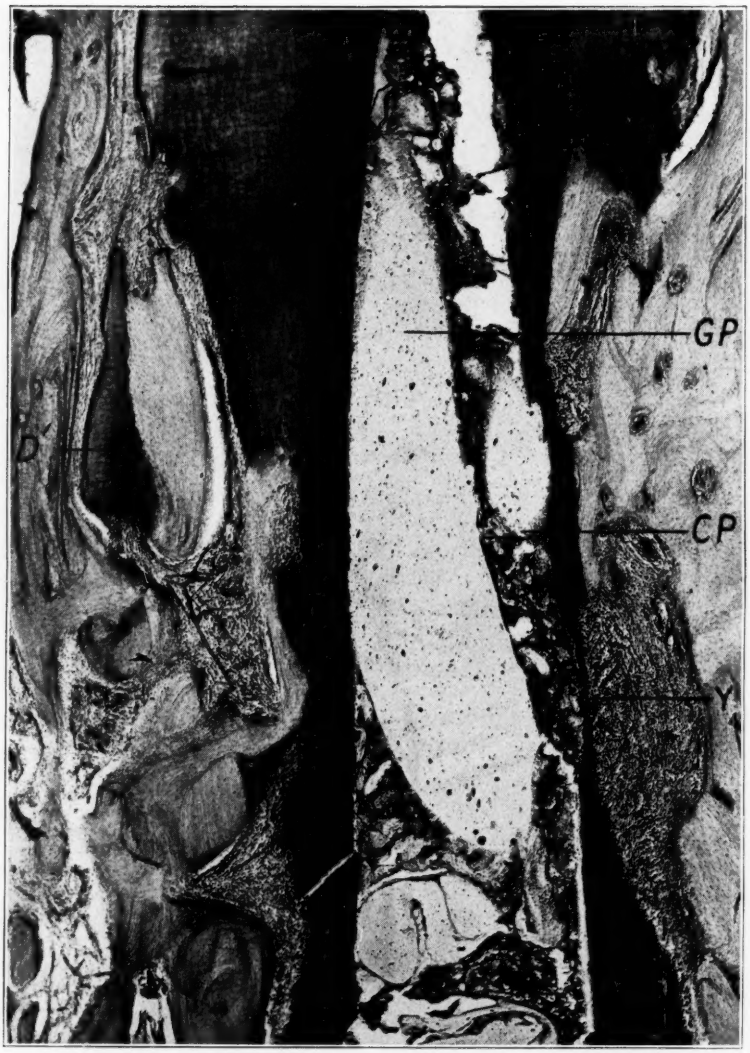


Fig. 5.—Higher magnification of area X, Figure 3, taken from a neighboring section. *D'*, section of dentin entirely isolated by resorption. *GP*, section of a guttapercha cone. *CP*, plastic pulp canal filling material used in conjunction with the guttapercha, probably chloropercha. At *Y*, the connective tissue can be seen virtually in contact with the pulp canal filling. (× 25.)

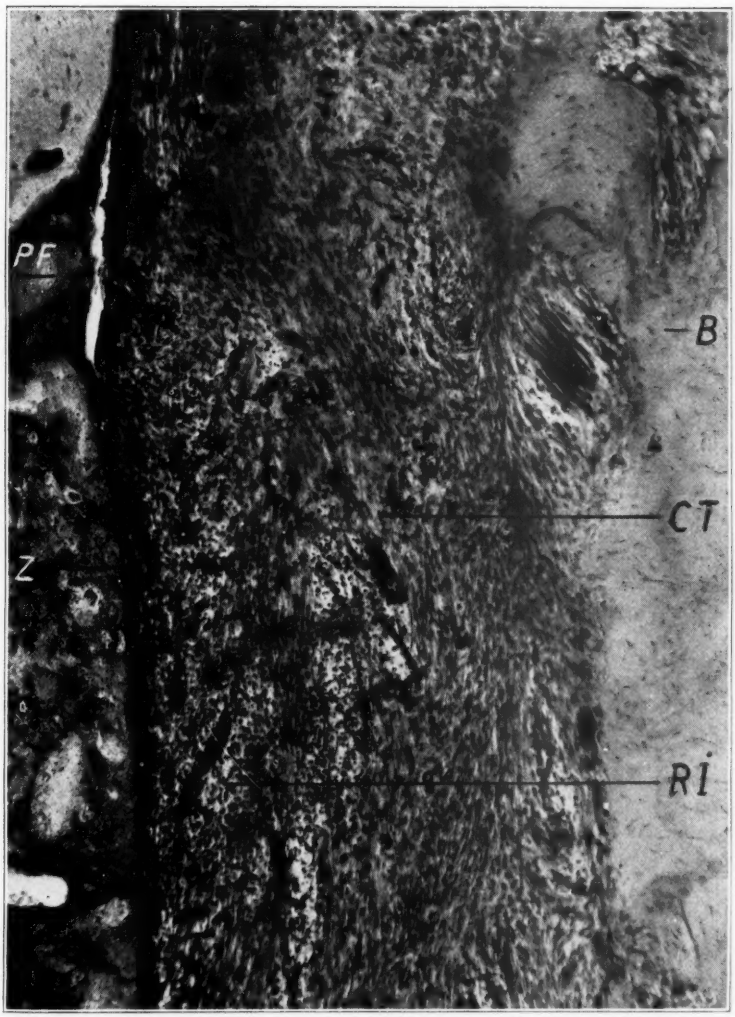


Fig. 6.—Higher magnification of area *Y*, Figure 5. The connective tissue *(CT)* lies in contact with the pulp canal filling material *(PF)*, all dentin being resorbed in this region. Nearest the pulp canal filling, there is marked round-cell infiltration *(RI)*, probably a reaction to the foreign body. The connective tissue nearest the bone *(B)* is free from infiltration. (× 120.)

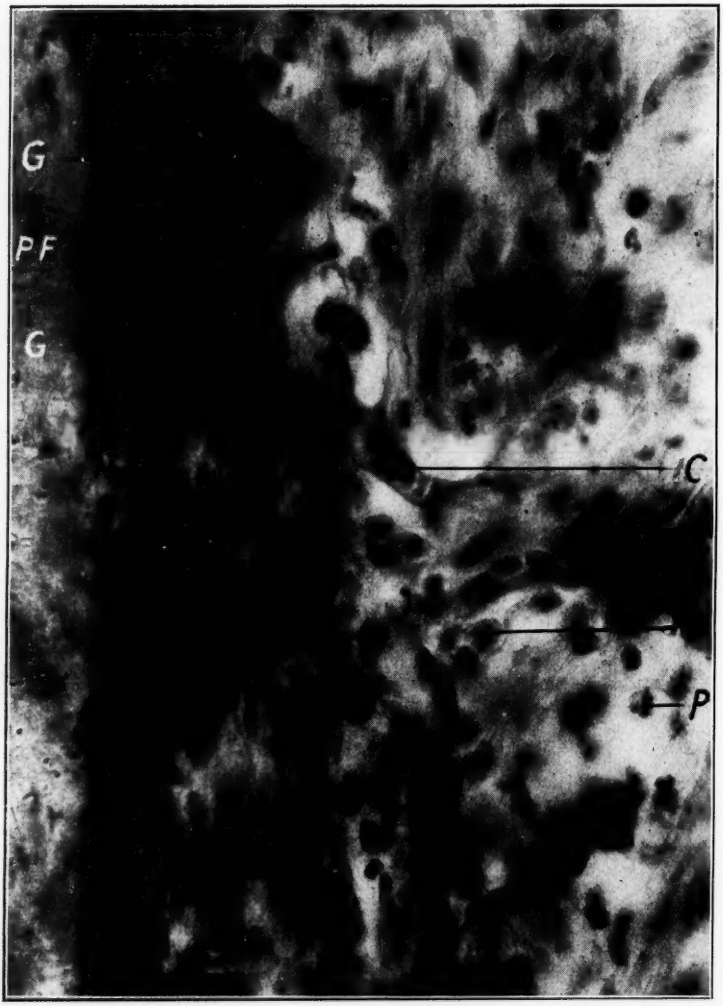


Fig. 7.—Higher magnification of area Z, Figure 6. Polymorphonuclear leukocytes *(P)* and two giant cells *(G)* are seen in the granulation tissue adjacent to the pulp canal filling *(PF)*. Such giant cells are often observed in the neighborhood of foreign bodies. *C*, capillary vessel. (× 750.)

between the ages of 12 and 14. At 12 years, twenty-eight permanent teeth are normally in full occlusion (the central incisors having been so for five years), with the exception of the third molars, so that further eruption must occur, if at all, in spite of the fact that each tooth is already occluding with its antagonist. At the same time, it must be remembered that between 12 and 14, the rate of this eruption would naturally be faster than would be expected during two years at a later period of life, because in youth all tissue changes occur more rapidly and more obviously.

Figure 1 shows a plaster cast made when the patient came in. The difference in length between the porcelain crown on the upper left central incisor and the natural crown of the right is evident. Figure 2 shows the right and left central incisors, with the porcelain dowel crown on the latter and the pulp canal filling; the unresorbed portions of the root at the apex and adjacent to the crown, and the deep resorption in the middle third of the root replaced by bone. The right incisor has moved to the occlusal line. It should be mentioned that clinically the tooth was not so loose as might be anticipated from this roentgenogram. It was, on the contrary, as firm as the other anterior teeth.

Figure 3 shows a mesiodistal section of the left central incisor root with a portion of the surrounding alveolar bone. Between the dentin and cementum of the unresorbed portions of the root at the apex and nearest the crown are large areas of resorption extending in some instances quite to the pulp canal filling. These areas of resorption are entirely filled in with bone and connective tissue, the bone in many places being deposited directly against the remaining dentin. In the pulp canal, the guttapercha cones and the plastic filling material can be seen, the latter having the appearance of chloropercha. This section does not show the apical foramen because of the slight curvature of the pulp canal, but it was observed in the other sections that the pulp canal filling was well adapted to the walls of the canal all the way to the apex. As no periapical tissue could be obtained with the specimen, the condition beyond the apex could not be studied.

Figure 4 shows another section of the specimen, nearer the labial surface than the preceding one. In this section, the continuity of the dentin is entirely lost, the deposit of bone making up the entire middle portion of the outline. How closely the bone is laid down against the jagged edge of remaining dentin can be seen.

Figure 5 is a higher magnification of area *X*, in Figure 3, taken from a neighboring section. At D, a splinter of dentin with its cover of cementum has been entirely cut off by the resorption and is now completely surrounded by bone and connective tissue. In the area *Y*, the connective tissue is practically in apposition to the pulp canal filling material. A higher magnification of this area (Fig. 6) shows a considerable round-cell infiltration in the connective tissue. It is most pronounced nearest the pulp canal filling and gradually disappears in the direction of the bone. Figure 7 is a still higher magnification of area *Z* in Figure 6. Here, polymorphonuclear leukocytes may be seen in the granulation tissue nearest the pulp canal filling. There are also two giant cells in this field such as are characteristically present about foreign bodies embedded in connective tissue.

The etiology of this resorption may be questioned. In view of the fact that the pulp canal filling appears to have been a good one and that the resorption of

tooth structure occurred on the sides of the root surface, quite remote from the apex and leaving the latter intact, it is highly improbable that the pulp canal filling was responsible for the resorption in this case. It is much more likely that the trauma of the blow which broke the natural crown of the tooth so damaged the root surface that resorption followed.

A review of the literature dealing with similar cases of apparently shortened teeth discloses one reported by Gottlieb,[2] in 1923, in an article dealing with diffuse atrophy of the alveolar bone. A patient was seen to have a central incisor that was shorter than the adjacent teeth. A closer inspection revealed this shortened tooth to be the most firmly seated tooth in the entire jaw and possessed of the most favorable rate of eruption. The reason that this one tooth had not followed the accelerated eruption of the others could not be determined in this case.

Another case was described by Gottlieb[3] in 1924. In this case, an upper lateral incisor had seemed, during the course of several years, to become shorter than the other anterior teeth. The cuspid on this side had never erupted and a roentgenogram showed it to be impacted and impinging on the root of the lateral incisor. The cuspid was removed, and it was seen at the time of operation that the root of the lateral incisor was deeply indented where pressure from the tip of the crown of the cuspid had caused resorption. Because of this condition, the lateral incisor was literally locked in place and could not follow the movement of the other teeth toward the occlusal line. In the same paper, the case of an upper central incisor is mentioned in which a pulp canal filling had been placed when the patient was 14 years old. At the age of 20, this tooth appeared to be shorter than its fellow on the opposite side. The pulp canal was opened and resorption was found extending into the lumen of the canal. In this way, the tooth was stopped in its eruption much in the same manner as the one reported in this paper.

In 1928, Sicher,[4] of Vienna, reported three cases of apparent shortening of teeth, all upper central incisors. In the three cases, the teeth had had pulp canal fillings placed some years previously, and in all three, the treatment was rather unsatisfactory. Several attacks of periodontitis had occurred in each. One root investigated histologically showed a large area of resorption filled with granulations and newly deposited bone, in some respects not unlike our present specimen. Because of this condition, the normal eruption toward the occlusal line was stopped, and this tooth appeared to be shorter than those adjacent to it.

SUMMARY

The comparatively new concept that human teeth normally continue to erupt, at varying rates, throughout life has been demonstrated in histologic specimens by the presence of bundle bone and epithelial rests far from the regions of the apex. Clinically, this has been more difficult to show for want of a suitable fixed point from which to take measurements.

2. Gottlieb, Bernhard: Die diffuse Atrophie des Alveolarknochens (The Diffuse Atrophy of the Alveolar Bone), Ztschr. f. Stomatol., 21, No. 4, 1923.

3. Gottlieb, Bernhard: Ein Fall von scheinbarer Verkuerzung eines oberen seitlichen Schneidezahnes (A Case of So-called Shortening of an Upper Lateral Incisor), Ztschr. f. Stomatol., 22, No. 27, 1924.

4. Sicher, Harry: Die sogenannten verkuerzten Zaehne (Apparently Shortened Teeth), Ztschr. f. Stomatol. 26, No. 4, 1928.

In cases of shortened teeth like that described here, because of the inward growth of bone in the resorbed areas along the sides of the root, one tooth is securely held in the alveolar bone while the remaining denture continues to erupt.

# CONSIDERATION OF THE MAXILLARY SINUS IN RELATION TO THE PRACTICE OF DENTISTRY*

By LOUIS SCHULTZ, D.D.S., M.D., Chicago, Ill.

IN a paper read before the Chicago Dental Society,[1] I gave my position as to what cases belong to the rhinologist and what cases should be taken care of by the oral surgeon, basing it on the premise that, both having had the same fundamental training in the study of medicine, the question of who should properly attend cases of maxillary sinus disease was a matter of etiology, and the relation of etiology to the specialty represented by the one or the other group.

I have chosen this subject, stimulated by an important essay read before the Chicago Dental Society at the Midwinter Clinic. The author, G. E. Shambaugh,[2] is one of the leading rhinologists in this country. I gave a discussion of his paper, which decided me to offer a presentation from the standpoint of the dental practitioner, in order to make it as practical as possible and hence of value to my audience.

The maxillary sinus is the largest one of the group of paranasal sinuses, and owing to the acquisition of the upright position in the evolution of the human race, its drainage is very poor. Hence, of this entire group, it is the one most frequently infected.

Every head cold is probably accompanied by a maxillary sinusitis. Fortunately, resolution occurs in most cases, the sinus getting well as the nasal symptoms abate. This is of no special importance to the dental practitioner. Neither are other nasal conditions producing maxillary sinusitis, although all these are of considerable interest to the rhinologist.

The question of statistics as to the relative etiologic frequency of chronic sinus disease relates on the one hand to some acute constitutional infections or to infections of the nose and the other paranasal sinuses, and on the other hand to diseased teeth in close proximity to that cavity. The rhinologist holds that few cases are found that are caused by such diseased teeth and that most infections of this cavity have their etiology in disturbances related to the nose and other sinuses. Oral surgeons, on the other hand, are almost a unit in attributing most or almost all chronic sinus disease to dental conditions. This is not surprising, for a patient with a dental lesion causing the disturbance rarely finds his way to the rhinologist. Conversely, if

*Read before the Illinois State Dental Society, May 14, 1929.

1. Schultz, Louis: Maxillary Sinus Infection. Etiology, Diagnosis and Treatment, Dent. Items Int., 49:977 (Dec.) 1927.

2. Shambaugh, G. E.: Infection of the Maxillary Antrum, J. A. D. A., 16:773 (May) 1929.

the infection is due to a nasal condition, the oral surgeon is rarely consulted. My experience varies from that of both groups, because I treat diseases of the nose and throat as well as those of the oral cavity. Hence, I have had occasion in previous papers to take the position that the cause of chronic sinus disease is probably evenly divided between dental and rhinologic disturbances.

Several points which Dr. Shambaugh mentioned in his paper are of common interest to both groups. One of them is that chronic maxillary sinusitis is of much less importance than are either teeth or tonsils or than is commonly believed, as far as focal infections are concerned.

He also condemns meddling with a sinus opened by the extraction of a related tooth. I fully agree and wish to emphasize his position in both instances. I know of no better way to infect a perfectly normal maxillary sinus than by passing a probe or other instrument into the socket of such a tooth to make sure that the suspected opening really exists. Worse than that is the ill-advised practice of irrigating such a sinus. Morever, there is no method so productive of lasting mischief and so inexcusable as that of introducing a curet and scraping out the mucous membrane of that cavity as far as this is physically possible. That is no doubt the worst practice patients can be subjected to. When I see cases with such a history, but without infection in spite of this treatment, or if during an extraction the sinus is opened in my hands, I close the gum just as much as possible by a few sutures. Under no circumstances do I introduce an instrument into the socket, especially a curet. This instrument is a very good one, when used intelligently and where indicated. Under all other conditions it becomes a formidable menace to the welfare of the patient.

With reference to the relationship of this cavity to focal infections, I also endorse all Dr. Shambaugh says. He refers to the fanatic search for sinus disease when this cavity shows no frank infection and when it is not causing trouble. He cites headache as furnishing grounds for accusing the sinus of being diseased, when most cases of maxillary sinusitis are free from this symptom. He refers to certain methods used with the intention of fastening culpability on that cavity, which are quite ingenious. I strongly suspect that perhaps he had in mind, among others, the method described by Sewall.[3]

This operator aspirates the sinus under sterile precautions. If he finds fluid, it is examined microscopically. If air enters the syringe, he fills the sinus with sterile water or a sterile isotonic solution. The liquid is now aspirated and subjected to microscopic examination. Both sides are studied at the same time, different instruments being used to prevent error in the findings. If the aspirated fluid is frankly contaminated, he makes a slide from it; but whenever he finds no gross evidence of contamination in the aspirated fluid, it is centrifuged and a slide made from the sediment. He bases his conclusions on the premise that a normal sinus contains no cellular elements. Hence, if he finds some mononuclear leukocytes, he interprets such a picture as one of low-grade infection. Should he find polymorphonuclear or both mononuclear and polymorphonuclear leukocytes, he infers a more active process. His conclusion is that many maxillary sinuses formerly considered normal are really diseased.

3. Sewall, E. C.: Ann. Otl., Rhin. & Laryn., 37:642 (June) 1928.

I have spent your time in submitting this technic, because it illustrates what errors men may commit in treating perfectly harmless sinuses. A perforation of the external nasal wall carries with it quite a probability of cytologic findings in a subsequently centrifuged sediment as just described. I cannot escape the feeling that when we have to hunt for disease in that manner, we are wasting our efforts. A frankly infected sinus does not usually require microscopic examination of the aspirated fluid. It is pus, and pus is macroscopic. In cases in which inspissated pus below the aspirating needle is stirred up by irrigation and is aspirated, it is questionable that a microscopic examination is indicated, except for scientific reasons. Clinically, that kind of sinus is not giving trouble. Moreover, when we recall that a maxillary sinus may and often does act for months as a reservoir for the discharges of a suppurating frontal sinus without harm to its lining, recovery occurring when the frontal sinus is properly taken care of, the fallacy of interpreting serious disease of the maxillary sinus becomes obvious. I am unable to grasp the clinical significance of microscopic findings in centrifuged deposits in such cases, for such a sinus is of no local annoyance to the patient. Also, I see quite a number of patients suspected of maxillary sinus disease who have no such disturbance at all and who get well when the real cause is found and treated. To illustrate, let me cite just one such case:

A man, aged 38, complained of frontal headache, beginning in the forenoon, worse at night and entirely relieved on waking in the morning. Under homatropin, no ocular disturbance was found. He had pains at the right inner canthus and the root of the nose, but no pain on deep pressure on either maxillary or frontal sinuses. Yet somebody had repeatedly irrigated both these cavities, always with a clear return flow, and of course without benefit to the patient. An examination revealed an anterior ethmoiditis, which yielded to an astringent nasal spray. The headache persisted until a marked constipation was relieved. A rational régime, including proper diet, proper exercise and correct habits, cleared up the picture without the use of medicine in any form. Even bran and mineral oil were unnecessary.

Let me say in this connection that chronic constipation may be responsible for practically any type of symptom complex.

An acute maxillary sinusitis is often healed by the use of an astringent nasal spray. If it is more resistant, irrigation with physiologic sodium chlorid solution or some other bland wash will result in a cure. By irrigation, I mean the perforation of the external nasal wall under the inferior turbinate, permitting the return flow to come back through the ostium maxillare. Subacute, frequently recurring and even most chronic cases yield to increased ventilation and better drainage by window resection.

That none of the foregoing measures suffice in the presence of a foreign body in the sinus is true, contrary opinion being given due weight and consideration. A broken root, metal, wood or other foreign substance in the sinus must be removed, if the patient is to get relief. The roentgenogram showing the foreign body in relation with the sinus does not necessarily prove that it is in the sinus. It may be between the gum and the bone or between the lining membrane of the sinus and the bone; hence, caution should be exercised in judging just where it is. A root end pushed into the sinus may often be removed through its former socket. This requires accurate roentgenography, a favorable position of the root and some skill. If handled properly, it can be removed very often without the knowledge of the patient.

Chronic maxillary sinusitis may be due to a protracted acute infection or to an infection of related teeth or a polypoid degeneration of its membrane. In this form, there are always permanent changes in the mucosa. The unilateral nasal discharge present may be intermittent or continuous. It varies from a thin cloudy material to thick, yellow, opaque pus. Again, I wish to caution against mistaking such findings alone for a chronic maxillary sinusitis. The underlying cause may be an unrecognized frontal sinus discharge into the former cavity. And, as stated above, in such a case it may act as a reservoir for months and its mucous membrane remain normal.

In making a diagnosis, the history is all important. This should be supplemented by transillumination and the use of the roentgen ray. The two latter, while serving as aids, are very valuable. Cases arise from time to time in which there is no discharge but there is a shadow both by transillumination and in the roentgenogram. But, in such a case, the return flow on lavage is clean, and there is probably not much danger that infection is present because there is no discharge.

### TREATMENT

An astringent nasal spray should first be tried in recent and uncomplicated cases. Those with a thickened membrane improve when better ventilation is secured by a permanent opening through the external nasal wall under the inferior turbinate. A discharging sinus should be irrigated, the frequency of the irrigations being regulated by the severity of the case. If the discharge does not yield to lavage, the intranasal window resection mentioned above should be resorted to for better ventilation and drainage.

I realize that there are cases which need a more radical treatment, such as the Caldwell-Luc operation; for example, a cyst so placed that it cannot well be dealt with in any other way, polyps which do not yield to a window resection, certain cases of foreign bodies in the sinus, or anatomic nasal difficulties making a nasal approach for a window resection physically impossible.

Except in cases in which an accidental opening occurred at the time of tooth extraction, followed by a discharge of pus, either from a normal sinus infected at the time of the accident, or from a previously infected sinus, irrigation of that cavity through the mouth should never be undertaken. I mention the Cooper operation only to condemn it. It is fundamentally wrong and violates a basic principle in surgery. Obviously, it is poor surgery to connect a normally infected cavity such as the mouth with a normally sterile one such as the maxillary sinus when the latter is infected, and expect to get good results from such action.

For the sake of completeness, I mention the Kuester operation, which contemplates entering the sinus through the canine fossa. This is the operation of choice for the removal of a foreign body, or a tooth erupted into the sinus, or perhaps in some cases of dental cysts. Needless to say, the opening should be closed at once, and the cavity should not be packed, except to arrest an otherwise uncontrollable hemorrhage, nor should plugs be used. For all other cases, the window resection in the external nasal wall is the operation most uniformly successful. With due care, the window is made to extend throughout the entire length of the turbinate, so that if septums should divide the sinus into several chambers, all may be drained.

The Caldwell-Luc operation, alluded to above, is indicated in cases of polyps,

foreign bodies, cysts, etc., which demand direct access to the sinus proper in addition to better ventilation and drainage. This operation should be in a hospital, and it is best performed under a local anesthetic. The Dahmer operation is synonymous with the Caldwell-Luc.

Other operations on the maxillary sinus exist which are more radical than the Caldwell-Luc, the most radical described in this paper. Among these are the Mikulicz-Krause, the Canfield, the Denker and the Canfield-Ballenger operations, but they are not of importance to us. I have not yet met a case in which I found one of this group necessary.

Malignant tumors springing from or invading the sinus are a great menace. Their early detection with efficient treatment is paramount. For even then the mortality is uncomfortably high. Thorough histories, accurate and complete clinical findings and roentgenograms in perfect focus and of good detail will help to bring such cases to operation while a cure may be possible. Early diagnosis may prove to be life saving. It transcends in importance all other considerations of these parts. It is pitiful to see cases in which, through delay or ill-advised or insufficient surgical interference, a cure has been made impossible. All that can be done for such unfortunates lies in palliative, life-prolonging, pain-saving measures but not life-saving operations. Roentgen ray and radium, valuable as they are in these cases, are no more curative than is surgery. Therefore, I again stress the importance of early diagnosis and early intelligent action in malignancy.

In order to produce the surest and most lasting effect, I have purposely placed the point I want to stress most at the end of this essay. Though I have alluded to this in the early part of the paper, I repeat it for the sake of greater emphasis. So often I am confronted with statements about as follows: That in the extraction of a tooth related to the sinus, this cavity was opened; that this opening has not closed, and that the sinus has become infected, although the socket including that portion of the sinus was well curetted at the time.

A more pernicious action than curettement under such circumstances does not exist. Years ago, I used to remove the lining of the maxillary sinus in many sinus operations, for from the time I was taught the Kuester operation in my dental studies to the time when I specialized in oral surgery and diseases of the nose and throat, the removal of the lining of the sinus was advocated and was common practice. However, I quit doing that a long time ago. I realize that, by such a method, I made invalids of quite a number of patients unwittingly, and now scientific surgical considerations having changed, I never remove that lining if I can possibly avoid it. The mucous membrane, diseased as it may be, is a highly specialized structure, never restored if destroyed. Its function is permanently lost. Its place is taken by scar tissue notoriously poor in blood supply and subject to malignant change. Why then scrape it off, when the extraction of a related tooth happens to give access to it?

If I must do the Caldwell-Luc operation for polyps, I remove this area of degeneration with a piece of gauze on my finger. A curet is not introduced. I rely principally on proper intra-nasal ventilation and drainage by a window resection. Yet, even with this operation, a cure in the sense of a reestablishment of normal anatomic and physiologic relations does not result, but by it the patient is made comfortable. As a sequel, the patient has no discharge, except perhaps

when afflicted by an acute rhinitis, and, in that event, needs but an occasional simple irrigation, which he should be taught to give himself. The advantage of an intra-nasal ventilation over all other methods of treatment lies in the fact that it connects a normally sterile but now disturbed sinus with the normally practically sterile chamber of the nose.

Let me protest, therefore, with all the emphasis at my command against the removal of any or all the lining of the sinus and let me brand such interference as a perniciously meddlesome procedure. May I close with the admonition to taboo the curet, to spare the lining of the maxillary sinus or any part of it and to carry away the thought that since this highly specialized membrane is never restored, if destroyed, our duty lies in its preservation rather than in its wanton destruction.

# BLOOD CHEMISTRY AND ITS RELATION TO PERIODONTAL PROBLEMS*

By SYDNEY R. MILLER, M.D., Baltimore, Md.

I APPEAR before you with mingled feelings of pleasure, regret and fear. Pleasure, not merely because you have so graciously honored me, but particularly because it affords me the opportunity to acknowledge again the personal debt which every physician owes to the dental profession. Medicine and dentistry are not fundamentally separate professions, but rather branches of one art and science, which has the common aim of the prevention and alleviation of human illness and suffering. Internists, particularly, have been intrigued and stimulated in the recent years by the correlations which have been established between dental and gingival conditions, on the one hand, and diseased conditions elsewhere in the body. It is a pleasure to note how eager your particular branch of dentistry is in the quest for information as to how extra-oral conditions may influence the teeth and the tissues adjacent to them.

Regrets intrude mainly perhaps because of selfish motives engendered by an admitted paucity of dental knowledge, which is a daily handicap. In my days at medical school, dentistry as related to medicine was an utterly untouched subject. Now, an internist is presumed to be one whose grasp on his own subject is fairly encyclopedic, particularly as far as he is equipped to appraise and utilize the significance of factors which primarily are not purely medical. It is lamentable that physicians today know and use so little dental discernment. The Carnegie Foundation Report on Dental Education in this country and Canada has already done much to point the way; yet in seven of the foremost medical schools in the United States, no systematic instruction is given the students of medicine in modern concepts of dentistry.

*Read before the American Academy of Periodontology, Washington, D. C., Oct. 3, 1929.

The moral is obvious and the hope is expressed that early correction of such a state may come, sponsored in large measure by the insistence of such organizations as yours. People are much more concerned regarding a dentist's or physician's ability to adapt facts which may be of value to them than in their academic propensities. Regret is inevitable when one sees so often the woful disregard of facts which physicians and dentists alike display—bad judgment, we call it. Good judgment, as defined by a patient of mine, consists of an accurate knowledge of the facts, combined with a proper consideration of the value of things. Mark this well: The tremendous advances in knowledge have made it necessary for the dentist to know something of medicine and the physician, of dentistry, if, as advisers in matters of health, we are to use good judgment. Since we cannot know all, it becomes a matter of knowing the relatively important and unimportant value of things in our practice.

The last feeling—one of fear—is perhaps not truly that, but rather timidity, for I strongly suspect I shall have little that is new in the way of information to give, little with which you are not already familiar. As a matter of fact, this paper will turn out to be quite comparable to the school boy's definition of salt: "A substance which makes potatoes taste bad when you don't put it on." Negative facts will be much more apparent than positive ones; what we do know, much more impressive than what we do. Paradoxical as it may sound, the inherent difficulties of our problem constitute a fortunate state of affairs. Difficulties do or should arouse the normal emotion of wonder and its associated instinct of curiosity. Together, they "stimulate the impulse to examine more closely the object or difficulty which excites them." The curious mind is ever alert. It remains sensitive to all that is doubtful or unsettled. Demand for the solution of a perplexity is the steadying and guiding factor in the entire process of reflection. It is with such a view that I shall attempt to cover the subject allotted, in an effort to make obvious, accredited facts, as well as the gaps in our knowledge, with the hope that they may soon be bridged.

## THE SIGNIFICANCE OF CHEMISTRY TO LIFE AND DISEASE

Chemistry is so deeply involved in life phenomena as to become of necessity a partner with medicine and dentistry in their efforts to preserve life. Life itself is a chemical function. The body is made up of innumerable cells, each one a miniature chemical factory, carrying out its allotted task and making its own contribution to the substance and function of the body as a whole. By reason of this physiologic division of labor, each cell contributes that special activity which is essential to the association of chemical processes that constitute the living individual. The energy of the body is all derived from the chemical energy of the food; and the sum of the chemical changes involved, whether they lead to molecular simplification, as in combustion, or to complexity, as in the manufacture of tissue capable of carrying on vital function, is known as metabolism.

The laws governing metabolism are predetermined and fixed, and operate interminably. Individuals are but incidents in a chemical sense. Life persists and health obtains, provided metabolism proceeds along normal lines. Variations result in altered function and illness of varying degree; marked aberrations end in death. In health, Nature is consistent: normal chemical processes result in normal function. Even in disease, her ways

are not haphazard; uniform alteration in metabolism will probably result in a uniform type of perversion of function. This may find expression subjectively in symptoms or objectively in signs, and may be accompanied by correlated chemical changes which can be determined qualitatively or quantitatively in the laboratory. It is this consistency which makes diagnosis possible.

Three considerations enter into the process of establishing both a clinical diagnosis and appropriate therapy: (1) what the patient can tell of his illness—his history, as we call it; (2) the objective findings which the dentist or physician can discover through the utilization of his five senses; and (3) the laboratory findings as revealed through studies of the blood of various types, the body juices and the execreta, and by the roentgen rays. It is to blood chemistry findings in particular that attention is directed today.

## APPLIED CHEMISTRY IN CLINICAL MEDICINE

The application of chemistry to medical diagnosis, prognosis and treatment is a field so large that no one could adequately discuss it within the scope of a single paper or volume. Inorganic, organic, colloidal, physical and biophysical chemistry has each added its share of the knowledge by which we know more today about life and its progression. In times past, in the study of the excretory organs especially, the main emphasis was placed on the changes in the character of the excretion, as for example, the urine, gastric contents, feces, sputum, saliva, cerebrospinal fluid, bile and various types of transudates and exudates. These studies have been in no sense supplanted, nor has their value been one bit minimized by the present tendency to study the blood, in order to ascertain what has accumulated there as the result of the failure of an excretory organ to carry out its function, or the decrease of substances normally present, for any reason whatsoever. This change in point of view is the *raison d'être* for modern clinical blood chemistry.

It seems quite unnecessary at this time to indulge in any discussion as to the technic of blood chemistry studies, the choice of methods, colorimeters, etc. Suffice it to say, the procedure is not difficult, though quite beyond the daily practical utilization of the average dentist or physician. Fifteen to twenty cubic centimeters of whole blood, secured, preferably, in the morning before the patient has eaten, and put in an oxalated bottle to prevent coagulation, will suffice to permit all of the examinations ordinarily employed. These studies may be grouped as follows:

(1) Those to detect evidences of deficient nitrogen elimination.

(a) Urea nitrogen (nonprotein nitrogen).

(b) Blood uric acid.

(c) Blood creatinin.

(2) Those to detect evidences of faulty carbohydrate metabolism.

(a) Blood sugar.

(3) Those employed to detect disturbances in the acid-base equilibrium, referred to usually as acidosis and the rarer condition of alkalosis.

(4) Those used to detect faulty fat metabolism—cholesterin.

(5) Those which detect alterations in inorganic constituents, including chlorids, magnesium, phosphates and calcium.

*Group I.*—Evidences of defective nitrogen elimination are of the greatest use in the clinical conditions of nephritis, acute or chronic, and especially those in which there in much glomerular degeneration or destruction. It is particularly

in such diseases that blood chemistry gives evidences of nitrogen retention as shown by the determination of the so-called nonprotein nitrogen, urea nitrogen (about one-half nonprotein nitrogen), uric acid or creatinin. The kidneys in health and disease have so-called thresholds for the elimination of these substances. Thus, creatinin is handled or eliminated with greatest ease, uric acid somewhat less so, and nonprotein nitrogen or urea, least of all. In general, therefore, nonprotein nitrogen values will show rises above normal before the others. When creatinin becomes permanently high, it is generally regarded as a reflection of the very serious and advanced state of renal disease, with an outlook for shorter and shorter life as the values rise.

Abnormal nonprotein nitrogen values are found in conditions other than nephritis, as, for example, in anhydremia, protracted vomiting and diarrhea, gout and arthritis, obstructive lesions of the genito-urinary tract, various forms of poisoning, especially mercury, intestinal obstruction and cardiac decompensation. On the other hand, the degree of nitrogen retention does not by any means parallel in all instances the severity of the underlying condition. As a matter of fact, these determinations, in my experience, are more directional and confirmative than truly diagnostic. Properly used clinical judgment will more often predict what the blood findings will show than not; whereas, too implicit reliance on these tests will deceive and disillusion the casual clinician. In all of the conditions in which blood nitrogen studies may be of value, a clinical diagnosis is relatively simple and the blood findings become more of value in following the clinical course of the disease than in a truly diagnostic sense. Single estimations are but rarely of permanent, conclusive value, and, in the early stages of clinical nephritis, are quite as often normal as otherwise.

Uric acid in the blood is almost always increased in the clinical condition of gout. When there is no true renal involvement, there is no constant increase in the more usual forms of arthritis, especially the infectious type.

*Group II.*—Blood sugar determinations find their greatest value in both the diagnosis and the treatment of diabetes mellitus. Our knowledge of blood sugar variations is perhaps more exact than any other constituent of the blood. By proper sugar tolerance tests, alimentary glycosuria can readily be differentiated from true diabetes, and so-called renal diabetes from the pancreatic form. Studies of blood sugar and sugar tolerance are of further aid in the recognition of some of the disorders of the glands of internal secretion other than the pancreas. Thus, the condition of acromegaly, or overactivity of the pituitary gland, is accompanied by a low carbohydrate tolerance, associated with overgrowth of the bony framework, hag teeth, etc.; underfunctioning of this gland, with an increased tolerance for sugars. It is interesting in passing to note that insulin will control acromegalic diabetes, but not so successfully as in the pure pancreatic form.

*Group III.*—For the normal life and functioning of each cell in the body, a constant environment is necessary; namely, the blood, the composition and reaction of which is regulated within very narrow limits. In health, this so-called acid base equilibrium is perennially maintained, despite the constant introduction of acids and bases in our food, and their formation within the body. We shall soon cease to cherish or tolerate the daily

phrase, "acidity of the blood," once we remember that blood as acid as distilled water, or as alkaline as ordinary tap water, is incompatible with life. When, for any reason, an impairment in this acid base mechanism occurs, and the transfer of carbon dioxid from the tissues to the breath is interfered with, acidosis, which may be acute or chronic, supervenes. It occurs almost always secondarily to some other disease, particularly diabetes, in some forms of nephritis characterized by phosphorus retention, conditions causing dehydration of the body (cholera, severe diarrhea), the excessive intake of certain salts and in many types of toxemia. The reverse condition, spoken of as alkalosis, ensues when there is an excessive loss of acid from the body or an abnormally large intake of alkali, and, once developed, may closely simulate the condition known as tetany.

Both acidosis and alkalosis, suspected clinically, can be quantitatively recognized by the employment of a variety of blood chemical studies, the easiest of which is the determination of the hydrogen-ion concentration.

*Group IV.*—Blood chemistry methods dealing with altered fat metabolism need but a word in passing. Their development is not well established, and though blood cholesterin studies are of suggestive value in certain rare forms of nephritis, jaundice and the primary anemias, they have as yet no practical clinical application.

### BLOOD CALCIUM STUDIES OR CALCIUM METABOLISM

Because of your chairman's emphasis on the subject as well as the fact that it admittedly is of extreme importance in the whole field of dentistry, I shall devote more time to the discussion of calcium metabolism than to all the others, and shall pass over entirely any reference to magnesium and potassium in the blood, for, in a word, we know little of practical value about them, in a blood chemistry sense. As far as the phosphates go, retention is known to occur in interstitial nephritis; whereas, a reduction is very commonly associated with active rickets, and is at least one factor in the improper calcification of bone in that disease.

The importance of calcium has long been recognized, and as far back as 1647 Ambrose Paré, a famous surgeon, suggested a relationship between absence or a deficiency of calcium and pronounced malnutrition. It was not until 1921 that Kramer and Tisdall perfected a microchemical method for quantitative blood calcium analysis, and, with but minor modifications, this is still the best method today.

From an enormous literature, ably reviewed in 1928 by Stewart and Percival in *Physiological Reviews,* one can cull briefly the following significant facts, and these in turn suggest certain practical applications:

1. Calcium salts, no matter in what form, are absorbed with manifest difficulty and by far most of the ingested calcium is lost in the feces. The absorption rate, or calcium availability, seems definitely related to protein intake, the sugar content of the diet and the solubility of calcium in hydrochloric acid; whereas, any excess of phosphates lessens calcium availability to a high degree and invariably leads to defective bone formation. Finally, it seems conclusively settled that an unsatisfactory relation between three dietary factors — calcium, phosphorus and vitamin D — leads to pathologic bony changes, mainly, it is thought, because vitamin D seems both

to increase calcium retention and at the same time either to stimulate hydrochloric acid secretion in the stomach or inhibit the flow of alkaline intestinal juices.

2. The most obvious function of calcium is related to the process of bone formation, but much information is still lacking as to how the transference of calcium from the blood to the growing bone is effected. Calcium is requisite to the normal functioning of all cells and is a factor necessary in preserving the correct balance of inorganic ions, spoken of as isotonicity. Calcium salts, when deficient, seem to bear a relation to certain forms of diarrhea, and, conversely, when in excess, to obstinate constipation. Hence, the view that calcium exerts some regulating influence on intestinal peristalsis. There is much evidence that calcium plays no small rôle in maintaining the proper hydrogen-ion concentration of the blood. The long recognized function of calcium with reference to the coagulation of the blood hardly requires more than a mere statement of the fact. Calcium is essential for muscular contractility and as well for the conductivity and irritability of nervous tissue.

3. As far as methods go, it appears that quantitative estimations of the serum calcium give the best results, and the accepted normal values range from 9 to 12 mg. per hundred cubic centimeters. There is apparently little difference in the serum content of calcium in infants, adolescents and adults. The only definite physiologic fall in serum calcium occurs during pregnancy, and is followed by a rise to normal after delivery.

4. Finally, the factors which control the calcium content of the blood are not definitely and certainly known. By reason of the bony changes in acromegaly and eunuchism, the loss of calcium in hyperthyroidism and diabetes and other endocrine disturbances, one after another of the various glands of internal secretion has been assigned the controlling influence over calcium metabolism. All the evidence is inconclusive, except as the parathyroid glands are concerned. Clinical and experimental studies warrant the statement that whatever other functions they may possess, the parathyroid glands exercise a definite control over the concentration of calcium in the blood, and particularly in maintaining the internal calcium equilibrium.

5. The constancy of blood serum calcium suggests that a delicate controlling mechanism must exist which balances absorption, deposition, utilization and elimination. There is growing evidence, too, to suggest that the accepted figures for total serum calcium do not truthfully portray the amount of so-called available calcium, and until simple and accurate measures are devised for estimating the available calcium in the blood, its therapeutic uses cannot be placed upon a strictly satisfactory basis. Thus, in parathyroid tetany, primary or postoperative, the use of parathyroid extract seems more logical and is more effective than calcium administration; and in rickets, the use of sunshine and vitamin D will do much more good than the use of calcium itself. Calcium is, and has been for years, given in many hemorrhagic conditions, in asthma, hayfever, urticaria and other conditions in which a calcium deficiency, assumed, is not borne out by consistent blood chemistry findings.

## BLOOD CHEMISTRY'S VALUE TO PERIODONTISTS

Even in such an incomplete and cursory résumé of blood chemistry and its value to medicine, the query might aptly be made: In what possible way or ways can such knowledge be turned to the advan-

tage of the members of this special branch of the practice of dentistry? The answer, as I see it, is both easy and involved; but before attempting an answer, let me digress for the moment, and go into a field where the display of my dental ignorance may be pitiful.

By derivation, your chosen profession is that branch of dentistry concerned with the tissues around the teeth, and, in particular, those processes, of whatever nature, which produce a breaking down of the periodontal structures. Such processes are broadly covered by the term periodontoclasia. Your interests center not so much in the problems of dental caries, root canal fillings, periapical abscesses and the like, though I suspect that they enter much into your problems, as in those conditions which injure the gingivae, occlusive anomalies and their resultant mechanical effects, in the production of soft tissue injuries, food packs and their chemical influences, infections in their relation to soft parts and the teeth as well, and, finally, in the cementum surfaces and the various anomalies and deposits encountered in the practice of apoxesis. Perhaps this does not cover all your special interests, but to me it seems quite enough, and your pardon is craved if I have left you too small a field to invade.

Now, as nearly as I can see it, periodontoclasia, in general, resolves itself into one of two main groups: Group I, in which either intrinsic inherited or constitutional factors, or acquired, extrinsic noninheritable factors exert their malign influences mainly through mechanical irritation, to which the secondary factors of infection may subsequently be added. These are primary and essentially local conditions. Group II, the so-called secondary group, which in many instances overlaps the first, although more often the local conditions are expressive of systemic disorder or disease in quite the same sense that Dr. Wilmer regards the eye as an indicator of trouble elsewhere for which the eye itself is not the cause but of which it is the victim. Grant for the moment the essential soundness of such a conception by a mere medical layman: it would seem, then, as far as blood chemistry is concerned, that it has little if any value in the recognition and treatment of conditions in the first group, with perhaps one rather wildly speculative exception. Recent and ever-increasing anthropometric studies serve to show more and more "type forms" or "habitus," each manifesting certain apparent disease tendencies. Already, we recognize clinically individuals of the asthenic, pyknotic, arthritic, neuropathic and digestive habitus, as well as those who show the thymicolymphatic constitution, and other endocrine imbalance, associated with which there are so many dental anomalies, enamel hypoplasia and dentition defects. It is conceivable that biochemical studies applied in these groups, and particularly at an early age in life, might shed some light on how constitutional heritage may be altered. The opportunity in this would come mostly through the teamwork and study of periodontists and pediatricians; for theirs, probably, would be the opportunity to see the earliest evidences of such abnormal states.

When one comes to the second group of periodontoclasia cases, the situation is theoretically very different, yet practically, in my opinion, quite the same. This is but another way of saying that blood chemistry, as it is now understood, holds nothing of daily routine value to the periodontal specialist, except in an indirect sense. Let me elaborate this by pointing out some of the dangers.

You have all witnessed the destructive effects that the so-called focal infection theory has left in its wake. Fortunately, the problem, though still not solved, is being viewed and dealt with in a more rational way. In an article in the *Dental Cosmos* in 1921, I called attention to some of the utterly absurd tests and ridiculous interpretations thereof which overzealous dentists were employing as the final criteria of the need, or otherwise, of extractions. The same menace confronts the medical profession today, in a period when tests, formulas and machines of precision, valuable as they are, are lessening the power to observe and provoking atrophy of logical deductive thinking. To interpret at all blood chemical findings is not possible without close clinical correlation: wide variations occur unless the factors of diet, fluid balance, etc., are carefully considered; and last, but by no means least, obvious pathologic deviations are by no means always significant in the way that one is taught to believe. Useful as they are, I am convinced that they have, as yet, value only when properly employed in selected cases. This opinion is a result of analyzing thousands of blood chemistry studies routinely applied in both ward and private practice.

Applying this certain personal conviction to your profession, I should feel that your knowledge of blood chemistry would better be translated into the early recognition of periodontal diseases not apparently falling into Group I, and hence probably due to some systemic disorder which needs ferreting out by medical aid. It would be interesting teamplay for the periodontist and internist to note, for example, any relation between local oral disease, in terms of advance or regression, in a chronic nephritic, for instance, and the rise or fall of retained nitrogenous substances; or a series of diabetics in relation to their freedom from glycosuria or consistently elevated blood sugar concentrations; a group of asthenic neuropaths in relation to their pronounced pyorrheal tendencies and subnormal blood chemical findings, and the alterations in each during periods of induced normal nutrition, with saner ways of thinking. Many other fascinating problems might be mentioned, but these will serve the point that I wish to stress once again: leave blood chemistry alone for the present, but recognize more quickly as dentists your need for help from an internist, just as we are growing ever more alert to the hostility of periodontal disease to health alone, and its sinister effects on established systemic disease.

In what way periodontal disease affects blood chemical findings, I do not know; nor have I been able to find any literature dealing with this phase of the question. If a large percentage of cases of periodontoclasia are local secondary manifestations of such diseases as nephritis, diabetes, abnormal blood conditions and disorders of endocrine and autonomic nervous system origin, abnormalities found in a blood chemical sense cannot logically be ascribed to the oral conditions at all. Further, to believe that many such systemic conditions have their etiology in the mouth, is, I take it, bad judgment; for an accurate knowledge of the facts warrants no such valuation of the findings to date. As far as I can see, periodontal disease, especially the suppurative form, for which, as yet no specific vegetable or protozoan organisms have been proved *directly* responsible, can influence blood chemical findings only by exerting a further malign influence on the primary systemic affection. Painstaking periodontal-medical correlation alone will affirm or refute this conception.

## CONCLUSIONS

The principles of preventive periodontia are, in a large measure, educational in character, demanding that the details of correct oral hygiene, proper and sufficient gingival stimulation and the adequate application of well established dietetic laws be taught to young and old, with an inspired insistency. The elimination of all irritating oral conditions is the mechanical and technical side of your problem. An ever broadening conception of the reciprocal relations between systemic diseases and periodontal lesions is the inspirational side, which everyone needs in his daily work.

It is hoped that the meager glimpse into the realm of chemistry and its revelations in a medical sense will serve as a genuine stimulus for the work which lies ahead. I do not mean in any sense to leave the impression that the advances in blood chemistry have not been valuable or practical: they have. Yet their value, in the last analysis, is more directional than definite, more confirmative than conclusive, and more suggestive than final. That deviations from the normal, in a chemical sense, concern you as well as internists, there can be no doubt; but refinements, both in methods and interpretation, need to be made before the finer variations can be given their proper and practical valuation. It is not too much to hope or believe that, in the not distant future, such advances will be accomplished.

Much of the work done, and to be done, is so technical and, in many instances, so remote in its relation to practical medicine, that the busy practitioner and dentist cannot keep pace with it all, if, indeed, he could grasp what it is all about. But bear in mind that the true aim of medical and dental research is to reconcile the results of laboratory studies with the clinical manifestations of disease. Many purely laboratory researches have failed for want of clinical direction. It is helpful not to forget that some of the most notable achievements in medicine, and in dentistry, too, I suspect, have been accomplished by men whose lives were spent far from laboratories or seats of learning. Let me mention four: Harvey was an obscure physician, struggling to make a living, when he first began to think of the circulation of the blood. Jenner, among the worries of a country practice, discovered vaccination against smallpox. Koch was a local physician when he began his work on tuberculosis. Mackenzie was a busy general practitioner in England, when he laid the foundations for his epoch-making work on the heart.

History and experience warrant the assertion that most progress is assured when clinician and laboratory worker pull together, each recognizing the difficulties faced by the other, and equally determined that those difficulties shall be solved as a result of their mutual efforts. In clinical medicine, the true value of laboratory methods has been enhanced rather than lessened by the frank recognition of their limitations, and this has been particularly true of many of the blood chemistry tests.

Progress in any altruistic profession is, by the very nature of things, inevitable. It is most consistent when plasticity of thought regularly surpasses the bigotry of narrowmindedness. It is stimulated in an atmosphere of appreciation and by frank, constructive criticism. It is fostered when the ideas or whims of the individual are kept constantly subservient to the weight of judiciously proven opinion. With such a point of view, dentistry can confidently expect increasing aid from medicine, and medicine from dentistry,

as we eventually learn more exactly just what the chemistry of health and disease really means.

DISCUSSION

*Justin D. Towner, Memphis, Tenn.:* The present theory regarding the etiology of periodontoclasia is toward the alkalosis index, and I should like to ask Dr. Miller what blood research could be made to establish the truth of this apparent tendency. We know that the pocket-forming type of periodontoclasia is directly opposed to the conditions in which we find caries. In the former, reactions are alkaline; in the latter, acid, and the one which assumes the ascendency more or less completely controls the other. This is suggestive only of further research, which has just begun to open up an avenue which we all may enter, and to which something of definite value may be contributed.

*Rudolph Kronfeld, Chicago, Ill.:* We often found that teeth which were lost by early loosening showed very hard and well-calcified crowns and yellowish enamel and were highly resistant to caries. Poorly calcified teeth with a bluish white enamel and a great susceptibility to caries seldom are lost by periodontoclasia, and show a favorable rate of eruption. So it seems that there is a certain antagonism between periodontoclasia and caries.

*Arthur H. Merritt, New York City:* Dr. Miller has answered many questions that have agitated the minds of many of us for several years. All of us know that there are cases arising in daily practice which seem to have a systemic background.

In a case which recently came under my observation, in a woman, aged 25, the thirty-two teeth were so seriously involved in bone destruction and periodontal disturbance that one of the best oral surgeons in New York advocated their complete removal. She appeared to be in excellent health except that she, in an effort to maintain her boyish figure, was perhaps undernourished. I decided that there must be some explanation of this case outside the mouth. I asked the family physician to make a careful physical examination. He reported on the blood examination and urinalysis as well as making the regular physical examination. He was unable to find any explanation for the condition in the mouth. With the approval of the patient, another physician was chosen who was known to be exceedingly careful in making, and particularly well qualified to make, such examinations. He reported that he could find nothing abnormal, and yet her mouth was so seriously involved that one of the best oral consultants recommended the complete extraction of her teeth to the family physician who had taken him into consultation. I remember a few years ago an article (written by a man in England) which was commented on by the editor of *Dental Cosmos*, saying that dental caries was the result of calcium deficiency and periodontoclasia with calcium saturation. I should like to hear from Dr. Miller in regard to this. My own clinical observation has not confirmed that statement.

*John Oppie McCall, New York City:* At the Dental Clinic of New York University, College of Dentistry, about four years ago, a child of 11 years was brought to my attention in the periodontoclasia clinic who had lost several of her permanent teeth, one or two incisors and also the first permanent molars in the lower jaw. She had quite high resistance to dental caries, and the condition of the mouth made it evident why she had lost the teeth that were gone. She had as extreme a condition of periodontal destruction as I am sure was to be found in Dr. Merritt's case. While it was not believed that anything could be done for her, we did try to help her, and finally I took her to my own office, though she was a clinic patient, to see if I could help her better there than in the college clinic; but it was all to no avail. In less than two years, she had lost all her permanent teeth and she is wearing full upper and lower dentures today. That was before the age of 13, and the condition was entirely typical, as far as any clinical examination could explain, of periodontal disease of the suppurative type with which we are all familiar. Her history was not conclusive in any respect. Her parents were ignorant people who had difficulty in speaking and understanding English and so the taking of the history was very unsatisfactory, but I am quite sure that she had no systemic disorder that was anything out of the ordinary. It was quite probable that she suffered from rickets in a mild degree in early childhood, but so have many other children whom we see who do not have such a disturbance in

the mouth. This is the most serious case of its kind that I have seen, but I recall a boy of 16 who was brought to the clinic later with essentially the same condition. There is no question that we have a systemic factor, but, as in the case of Dr. Merritt's patient, examination (including a blood examination, but I think not blood calcium determination) by physicians who were, I believe, competent, failed to show anything which would give us any help either in a diagnostic way or in the way of pointing toward possible therapeutic aid. The subject of blood chemistry, of course, is naturally associated in our minds with disturbances of this kind because not only do we see cases such as the ones that Dr. Merritt and I have cited, but we also see cases which show exactly opposite conditions. It is quite a common thing for us to see patients who have neglected their mouths, who have perhaps suffered from serious diseases, including diabetes, for instance, and who show little, if any, disturbance of the periodontal tissues. Traumatic occlusion does not invariably mean a breaking down of the periodontal tissues in the ordinary way, and it seems that there must be something, not merely a systemic condition, but something which could be determined in the blood by way of explaining these anomalous things. Dr. Miller has been giving us advanced information along this line. I realize that the problem is a difficult one, and I hope that he has become sufficiently interested in the subject that he will continue to study the subject of blood chemistry from the dental, and particularly from the periodontal standpoint, and come into closer relationship with dentists who may be able to help him clinically. I hope that he may soon give us the information which we are all looking for so eagerly.

*Isador Hirschfeld, New York City:* Apropos Dr. Miller's question and suggestions, it seems that observations may help us in checking up these cases of periodontoclasia with systemic factors. I have in mind a number of instances in which I have positive proof that gum recession was, in certain cases, generalized and that the recession had ceased at least a number of years prior to the time when I saw the patient, without any local treatment or any special attention locally. We have another point to consider, and that is, these cases of periodontoclasia, called lately in Europe "the horizontal type of pyorrhea," seem to be essentially not a type of distributed pyorrheal infection, but rather a secondary infection, you might say, in addition to the uniformly horizontal recession of the periodontal tissues. It is true we have two factors to contend with: the loss of the periodontal tissues without local infection and the breaking down of tissues as a result of periodontal infection. If we already have a pyorrheal condition superimposed on this generalized destruction of the periodontium, we are not in a position to know through determinations by medical men at that time whether the original systemic cause of this generalized recession is still present. In other words, if it is true that the original systemic etiologic factors have already been removed for some reason or other, perhaps through the endocrine system, and we have an infection present, are we in a position to know whether the condition we find at the present time is caused by systemic or local causes?

*H. J. Leonard, New York City:* We hope to inaugurate in Columbia University a series of chemical studies along this line, and it will be helpful to us if Dr. Miller will give us his idea as to what particular factors in the blood one might analyze first in attempting to determine the probable changes that have gone on, and that have delayed recovery from periodontoclasia. If we take as our hypothesis that there is some blood chemical change which is the cause of periodontoclasia, what, in his opinion, would be the first thing to look for along that line?

*Celia Rich, Nashville, Tenn.:* Could there be a serious endocrine disturbance and the blood still be normal?

*Dr. Miller (closing):* Dr. Leonard asked me previously as to how one would start blood studies on the theory that there must be something wrong in the blood that in some way lowers local resistance and permits conditions to develop; i. e., caries and periodontoclasia. That immediately brings up the whole subject of immunity. What is immunity? Is it a chemical process? It is so thought of by many, yes, but in what phase of chemistry does it fall? Is it colloidal chemistry or is it lipoidal chemistry, or whatnot? It has not been settled. There has been in recent years a great deal which has suggested that immunity is bound up very closely with the proper blood ionization of inorganic substances more than organic. That again is a hypothesis. It is certainly established that

the amount of ionized calcium in the blood, which is essentially what one determines when he makes a blood calcium study, is susceptible of not very wide variations from the accepted normal without reciprocal disturbances in the acid-base equilibrium. What relation that may bear to the question asked about the alkalosis index, I do not know offhand, but it probably would be slight, and the basis that it is so well established that the hydrogen-ion concentration of the blood can swing ever so slightly, as determined by the most accurate electrical methods of precision, before we get into the acidosis or alkalosis complex, that one would hardly expect to find very conclusive evidence in terms of mouth conditions when the swing is in such extremely narrow margins. As far as health is concerned, we feel that that is so, regardless of dental conditions. Perhaps there should be refinement along the lines of hydrogen-ion studies and particularly more studies with reference to the proven relation, and what the relationships that exist between available calcium, available phosphorus, and vitamin D really mean. There perhaps would lie a more fruitful field for chemical research rather than in correlated studies of clinical findings and blood chemistry methods. As far as the definite showing in the laboratory goes, that in caries there is a calcium deficiency and in periodontal disease an excess is not borne out by any studies that I know of which are satisfactorily controlled with reference to dietetic factors, etc. There again is a fruitful field for accurate research, but you see that there must be correlation as regards not only what you find in the mouth and what you find in the laboratory, but also what the patient takes into his mouth, in terms of food content, organic content, water content, etc. As they are all involved in the thoroughly intermingled process, you will never get results except by teamwork of that sort. The present methods employed in blood chemistry, as elaborated in the past eight or ten years, have reached such a stage that discrepancies between the findings of two observers on the same blood should be minimum unless one observer is color-blind. If he is color-blind, he is particularly unfortunate in this work, because practically all the determinations are colorometric. The results should check and do check, as a matter of fact, between different laboratories within such small fractions of milligrams that the difference means nothing. The last question asked is, "Can there be marked endocrine disturbances without gross blood chemistry alteration? Probably, yes. For example, the deviations from normal in a large group of cases of pronounced hyperthyroidism are not particularly significant or strictly diagnostic, nor are they altered by subsequent removal of the hyperplastic thyroid. One certainly sees finer shades of endocrine disturbances as revealed by constitutional defects or stigmas which do not show enough in the way of deviation from the normal to make those findings capable as yet of accurate interpretation. There is another fruitful field for someone to work in, to determine what endocrines are. They are just as vague as the vitamins, though we know they are important. We now know much about epinephrin and about insulin, and we are beginning to learn that there is apparently a close relationship between dietary deficiencies and abnormal chemical findings in pernicious anemia. We do not know how to determine in the blood whether a person has too much of the anterior lobe or too little of the posterior lobe in the pituitary gland; and if the lobe is too large or too small, what we can do about it. Whether blood chemistry is capable of detecting finer shades of alterations in normal or abnormal constituents of glandular origin might throw further light either on dental problems primarily or on their relation to alterations in inorganic chemistry. It is worth thinking about.

# DENTAL ANATOMY: A GRAPHIC REPRESENTATION OF CROWN FORMS, WITH TECHNIC FOR THEIR REPRODUCTION*

By M. DIAMOND, D.D.S., New York City

ANATOMIC differences are most marked between crowns of the incisors, cuspids, bicuspids and molars, because these teeth represent the groups possessing different specialized functions. Marked as these differences are, there are a series of landmarks that are common to the crowns of all teeth, some of these to only the upper teeth, others to those of the lower, and some that are identified with the particular tooth.

These landmarks, to be presently enumerated, are intended as definite guideposts for the easier assimilation of the descriptive anatomic detail, as well as for the development of the technic for the reproduction of crown forms. Wherever possible, the landmarks are to be identified with a definite purposefulness on the part of Nature to contrive the most efficient means for their particular usefulness.

With few exceptions, all teeth are developed from four primary parts, known as lobes. In considering the anatomic form of the crowns, it is important to consider (1) the form of each lobe, and (2) their placing or arrangement in relation to each other.

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It is in an understanding of both of these factors that an explanation of the gross anatomic variations between the crown of one tooth and that of another is to be found, as is the explanation for the detailed anatomic variations between the crown of a tooth in the mouth of one person and the crown of a similar tooth in the mouth of another.

The crown of the upper right central incisor in the mouth of one person basically resembles the crown of the upper right central incisor in the mouth of any other person, yet a careful examination discloses infinite variations, which in their extremes are very marked. So it is with the crowns of all of the teeth.

Stripped of these variations, the close kinship between the teeth of all human beings is readily established in a remaining common denominator or basic outline form. This basic form I choose to call the symmetrical tooth form. The variations themselves I have also attempted to classify, and they will be separately discussed.

## LANDMARKS

1. The crowns of all of the upper teeth are centered directly over the roots, so that if in the anterior teeth the incisal angle were bisected, and the bisector continued through the apex of the root, the labiolingual diameter of the crown would also be bisected.

2. Crowns of the lower teeth bear a somewhat different relation to their roots, in that they are all bent over or inclined toward the lingual aspect. This inclination is due to the leaning over or convergence of the labial surface of the anterior and the buccal surface of the posterior teeth, toward the lingual. This convergence is greater in the posterior teeth, and greatest in the lower bicuspids, where if the angle of the buccal cusp were bisected at its summit and continued downward in the direction of the apex of the root, the bisector would pass through its apex.

3. In the crowns of the anterior teeth, the widest mesiodistal diameter is to be found at the junction of the incisal and middle thirds, and in the posterior teeth, the widest mesiodistal diameter is to be found at the junction of the occlusal and middle thirds. In this region, that is, at the junction of the incisal and middle thirds of the anterior and the occlusal and middle thirds of the posterior teeth, a contact relation is established with the adjacent tooth.

The contact point is exceedingly important in that it serves as a definite means for preventing foods from being impacted in the interproximal spaces, against the delicate tissues.

4. The mesial and distal boundaries of the lingual surfaces of the upper anterior teeth, and the mesial and distal boundaries of the occlusal surfaces of all the posterior teeth, present well rounded bands of enamel, which are called the mesial and distal marginal ridges. These marginal ridges are rolled over toward the lingual surfaces of the upper anterior teeth, and toward the occlusal surfaces of the posterior teeth, and serve very much as the rim of a saucer to keep the masticated foods within the lingual and occlusal surfaces, preventing them from being jammed against the contact point within the interproximal spaces. These marginal ridges are therefore an important accessory to the contact points, in serving to protect the vulnerable tissues. It is interesting to note the total absence of marginal ridges on the lingual surfaces of the lower anterior teeth, against which there is no masticatory stress.

5. The widest labiolingual diameter of the anterior and the widest buccolingual diameter of the posterior teeth are found near the junction of the cervical and middle thirds. Placed at this point, the widest labiolingual and buccolingual diameters serve to protect the soft tissues surrounding the labial surfaces of the anterior and the buccal surfaces of the posterior teeth by slanting the foods, during mastication, off at a tangent, away from the soft tissues.

6. The mesial and distal surfaces of all teeth converge toward the cervical line from the widest mesiodistal diameter.

7. The mesial and distal surfaces of all teeth also converge toward the lingual aspect, the convergence of the mesial surface being somewhat the greater.

8. All mesial surfaces are rather straight in their cervico-incisal or cervico-occlusal directions, and all distal surfaces are convex in the same direction. Lower bicuspids, and particularly the first, are exceptions to this rule.

9. The cusp eminences may be divided into three types: (1) the well-rounded elevation; (2) those with a shallow depression or cavity, and (3) two irregular quadilateral planes at an angular relationship of approximately 120 degrees.

10. The cusp depth in the posterior teeth is usually one-fourth the height of their crowns. The greatest exception is with the upper first bicuspids, in which the depth of the cusp is between one-third

and one-half the length of its crown.

11. The marginal ridges of the posterior teeth have their respective positions in the cervico-occlusal diameter of the crown, and lie on the plane in between the summit of the cusps and the depth of the cusps, but close to the depth.

12. The depth of the cusp lies on the plane between the marginal ridges and the point of contact, which is one-third the length of the crown.

13. At the cervical line, a band of enamel is to be found surrounding the entire circumference of the crown, which rolls over toward the cervical line as it joins the root.

14. The labial surfaces of all the anterior and the buccal surfaces of all the posterior teeth slope away toward the distal aspect, in their mesiodistal convexities. The greatest slope is in the cervical third and gradually diminishes as the incisal or occlusal surfaces are approached.

15. The peripheral outline of the lingual surfaces of all the anterior teeth is smaller than the peripheral outline of the labial surfaces.

### SYMMETRICAL TOOTH FORMS

Of the four lobes that make up the upper central incisor, three are labial and the fourth lingual. The labial lobes all develop to approximately the same length; the central lobe is slightly shorter than the mesial, and the distal slightly shorter than the central. Mesiodistally, the central lobe occupies about one-fourth of the mesiodistal diameter, the remaining area being approximately equally divided between the mesial and distal lobes, with the mesial slightly the wider.

Evidence of union between the three labial lobes may be noted in the incisal and middle thirds, from the presence of developmental grooves which converge slightly in the direction of the cervical third, where they lose themselves, the three labial lobes merging into one smooth whole.

Each labial lobe has its individual convexity in the incisal and middle thirds, with approximately the same degree of labial prominence, the central slightly subdued toward the mesial, and the distal slightly subdued toward the central lobe. The mesiodistal convexity of the cervical third is even, sloping away toward the distal margin. This sloping away toward the distal margin of the mesiodistal convexity is to be noted on the labial and buccal surfaces of all teeth, and may be established as a universal landmark. The distal portion of the cervical third is more subdued than the distal portions of the middle, incisal or occlusal thirds. The purpose of this is to produce symmetry in the arrangement of the teeth for the arch form.

The cingulum is markedly convex in the mesiodistal direction, and very slightly convex in the cervical and incisal directions. The lingual aspects of the labial lobes are usually concave, forming together an even saucerlike depression, hemmed in by the marginal ridges, the incisal margin and the cingulum, all of which may be regarded as the rim of a saucer. Frequently, the centrolabial lobe will develop more fully in the direction of the lingual, and form a transverse ridge, running from the incisal margin and merging into the cingulum, which divides the even saucerlike depression into two depressions, the fossae, each being triangular in outline. Usually accompanying this condition, a tubercle, or a rounded elevation of enamel, will be found upon the cingulum.

Developmental grooves are merely evidences of union between the primary

parts and may be described as similar to the sutures of the cranial bones. They are to be found at the places of union between the primary parts and are best observed immediately after eruption of the crown, before any changes in masticatory stress have taken place. They do not play any rôle in the function of mastication. As a matter of fact, when the union is quite complete, the developmental grooves are hardly discernible or are completely worn away with slight masticatory stress. In the upper central incisor, the developmental grooves are therefore to be found on the labial surface, as already mentioned, and near the mesiolingual and distolingual line angles, where they separate the lingual lobe from the three labial lobes.

The symmetrical outline of the upper lateral incisor is identical with that of the central. The difference is chiefly in size, the proportions remaining more or less the same. The labial surface of the lateral is usually slightly more convex in the mesiodistal direction than the labial of the central incisor. The character of the variations of the lateral incisor are usually identical with the character of the variations in the central incisors.

*The Upper Cuspid Teeth.*—Transition in symmetrical form of the upper cuspid from the incisor is due entirely to a change in the development of the centrolabial lobe. This lobe develops much wider mesiodistally, occupying about half of the mesiodistal diameter. It develops more prominently labially, creating a much greater convexity mesiodistally, and develops longer than either the mesial or distal lobes, so that the eminence of the centrolabial lobe is approximately one-third longer than the eminences of the mesial and distal lobes. At this point, it is interesting to note that the formation of the incisal margin, as generally noted consisting of two straight arms at an angular relationship to each other, is not to be seen prior to the eruption of the crown, or immediately after the eruption. Instead, the incisal margin consists of three rounded eminences, which are the terminal ends of the labial lobes, and are formed on completion of the crown. These rounded eminences, called mamelons, are subsequently worn away by the stress of mastication, and the two straight arms that we are more familiar with are produced. In certain isolated cases, these rounded eminences may also be seen in adults, when the crown is either in lingual occlusion or in extreme labial occlusion, out of contact with the line of occlusion during mastication.

The centrolabial lobe also develops more fully in the direction of the lingual, and eliminates most of the concavity described in the lingual aspect of the incisors. The incisal and middle thirds of the lingual aspects are rather full, and only two very small triangular depressions are to be noted mesially and distally, hemmed in by the marginal ridges, the centrolabial lobe and the incisal arms. The widest mesiodistal diameter of the cuspid is usually slightly less than the widest mesiodistal diameter of the central incisor, and its crown length from the cervical line to the summit of the central lobe is rarely longer than the crown length of the central incisor. The fact that it appears so is due to the relative positions of the cuspids and central incisors in the maxilla.

*The Upper Bicuspids.*—In the transition between the cuspid and bicuspid, the lingual lobe plays the important rôle, in that the lingual lobe continues its growth in the direction of the occlusal aspect, almost reaching in its length to the summit of the buccal cusp. At the same time, it carries all of the landmarks found on

the lingual aspects of the anterior teeth to the occlusal surfaces of the bicuspids. The buccal half of the upper bicuspid is identical with the labial half of the cuspid. The proportions of the lobes mesiodistally are the same. The length of the crown is approximately one-third shorter than the length of the cuspid.

On eruption, the three rounded eminences or mamelons may be noted on the occlusal border of the buccal surface. These are subsequently worn away to form two arms, mesially and distally, similar to the arms of the incisal margin of the cuspid. The buccal part of the upper bicuspids occupies slightly more than half of the buccolingual diameter and is separated from the lingual half by the central groove, which extends mesially and distally across the marginal ridges and can be seen, on occasion, running across the entire length of the mesial and distal surfaces, close to the mesiolingual and distolingual line angles.

These developmental grooves have no distinct purpose, although Dr. Prime ascribes a spillway function to them. I believe Dr. Prime is in error for two reasons:

1. The developmental grooves as they traverse the marginal ridges are not constant in their position and location, and are most persistently to be noted only across the mesial marginal ridge of the upper first bicuspid. In most other instances, they very soon disappear from wear.

2. Nature never could have intended to place spillways in the direction of the interproximal spaces for the clearance of masticated foods, when she has attempted to be so careful to protect the tissues within the interproximal spaces by means of contact points and marginal ridges. Logical spillways are, and should be, in the direction of the point angles, where masticated foods find outlet buccally into the vestibule of the mouth, and lingually into the mouth proper.

The more evident the break across the marginal ridge, the clearer the evidence of irregularity in the development of the parts. Dr. Prime also contends, in matters of restoration of the proximal surfaces (which include marginal ridges), that if these spillways are not placed across the marginal ridge, evidence of irritation of the soft tissues will soon be noted.

I cannot agree with Dr. Prime. Gingivitis is due to another condition, usually to the position of the marginal ridge itself. The tendency in restoration is to place the marginal ridge too high in the direction of the summit of the cusps. Location of the marginal ridge is definite and can readily be determined by its relative position as it lies on the plane between the summit of the cusp and its depth. Its plane, while between the summit and the depth of the cusp, lies very close to the depth. The marginal ridges begin at the terminal ends of the arms of the buccal cusp, and slightly decline in their course to meet the terminal ends of the arms of the lingual cusp at the point angles.

The buccal cusp of the upper first bicuspid is very prominent, wider mesiodistally than the lingual cusp and somewhat longer. The planes of the buccal cusps are irregularly quadrilateral in outline, and in angular relationship of approximately 120 degrees. The arm in common to both planes, I choose to call the cusp ridge. Black speaks of it as the "triangular ridge." The bases of the planes together form the central groove, and the buccal margins of the planes form the mesial and distal arms of the cusp. Together, they form the occlusal border of the buccal surface. They merge to form the summit of the cusp and join

the marginal ridges mesially and distally at the point angles. The mesial and distal margins of the cusp planes are the mesiobuccal and distobuccal grooves, which run from the terminal ends of the central groove mesially and distally in the direction of the point angles. These grooves are the logical spillways.

The lingual cusp has an entirely different character. Its mesial and distal arms are rather convex, and merge at the summit to form a continuous convex line.

Its planes are slightly concave and merge to form a continuous slight depression. Rarely is there evidence of a cusp ridge, to form, along with the buccal cusp ridge, a transverse ridge, but when occasionally noted, it is an evidence of a slight overdevelopment, a tendency similar to the production of a tubercle upon a cingulum on the lingual lobe of the anterior teeth.

The space between the cusp ridges, which Black speaks of as the sulcus, I suggest another term for: the "inter-cusp space." "Sulcus" is in truth a misnomer; which may account for the general confusion in its application.

The base of the planes of the lingual cusps is the central groove, and their mesial and distal borders are the mesiolingual and distolingual grooves, which run in the direction of the lingual point angles. These grooves are the logical spillways. Within the boundaries of the mesial marginal ridge, the mesiobuccal and mesiolingual grooves, and within the boundaries of the distal marginal ridge, the distobuccal and distolingual grooves, small triangular depressions are found which are the mesial and distal triangular fossae. This completes the configuration of the occlusal surface.

The upper second bicuspids differ from the first only in matters of detail. The number of lobes and their arrangement are the same. The crown, on the whole, is generally smaller in all directions than that of the first bicuspid. The crown is shorter and the cusp depth assumes the proportions of one-fourth the length of the crown. The width of the central groove is shortened, and the marginal ridges are strangely heavier. On the whole, the general outline appears much less defined.

With the second bicuspid, there is a receding of the mesial surface toward the occlusal and lingual aspects. With the first, a receding of the distal surface toward the occlusal, which, with the mesial surface of the second, creates a rather wide lingual embrasure between the bicuspids. A general tendency is to regard the mesial surface of the upper first bicuspid as receding toward the lingual and occlusal, because of its approximation to the cuspid.

*The Upper Molars.*—In the upper molars, we are faced with apparently considerably more complexity. Analysis of the molar crowns shows them to be made up of the same number of segments as the bicuspids and the anterior teeth; but their arrangement and placing is radically different. Instead of three lobes toward the buccal aspect, we find only two, and two toward the lingual. One of the three buccal lobes skirts around to the lingual aspect and becomes the distolingual lobe of the upper first molar. The mesiolingual cusp of the upper first molar, on careful observation, proves it to be identical with the lingual cusp of the bicuspid. The oblique ridge connecting the mesiolingual cusp with the distobuccal might really be regarded as similar to the distal marginal ridge of the biscuspids.

Careful observation will disclose the fact that the distolingual cusp appears to

be added to the crown form, which in itself is already complete in its boundaries. Indeed, we may note the diminution of this distolingual cusp, out of proportion to the remaining parts, with the second and again with the third upper molars; and in about 50 per cent of the upper third molars, the distolingual lobe is completely dropped, only the three cusped crown remaining, with the oblique ridge, now becoming the distal marginal ridge.

In the crown of the upper first molar, we find all of the three types of cusps on the one occlusal surface. Each of the two buccal cusps consists of two irregular quadrilateral planes at an angular relationship of approximately 120 degrees. They are approximately the same size, each occupying about half of the mesiodistal diameter, and about half of the buccolingual diameter. The distobuccal cusp is slightly shorter than the mesiobuccal. The separation between the arms and planes of the buccal cusps, which the writer calls the "buccal notch," is about 100 degrees.

Of the two lingual cusps, the mesiolingual occupies about two-thirds of the mesiodistal diameter, and the distolingual, the remaining third. The space separating the lingual cusps, which I choose to call the "lingual notch," is formed entirely at the expense of the distal side of the mesiolingual cusp. I found this last observation a very important detail in eliminating much of the confusion incident to establishing the proper contour of this region.

For the developmental groove separating the two buccal lobes I suggest the term "bucco-occlusal" groove, since half of its course is upon the occlusal surface, and half upon the buccal. Similarly, the developmental groove separating the two lingual cusps, I suggest calling the "linguo-occlusal" groove.

Both of the lingual cusps are slightly shorter than the buccal. The distolingual is slightly shorter than the mesiolingual, or, to put it another way, the lingual half of the crown is slightly shorter than the buccal, and the distal half slightly shorter than the mesial half.

There remains little more to say about the upper first molar, except to call attention to the similarity of the pattern to that of the bicuspids. The marginal ridges are noted in a similar location, as are the triangular fossae. The mesiobuccal and mesiolingual, distobuccal and distolingual grooves run in the direction of the point angles, which bound the triangular fossae and are the logical spillways. The linguo-occlusal groove merges into the disto-buccal groove at the central groove, and the bucco-occlusal groove runs into the central groove at the deepest portion of the occlusal surface. The depression of the mesiolingual cusp here has the name of central fossa. This depression also encroaches slightly on the distal plane of the mesiobuccal cusp, and the mesial plane of the distobuccal cusp.

The central groove traverses the oblique ridge as it merges with the disto-buccal and linguo-occlusal grooves.

The general outline of the upper second molar is very similar to that of the first molar. Its crown is shorter, and it is wider buccolingually than mesiodistally, the outstanding difference being the diminution of the distolingual cusp. The third molar has identically the same pattern, but tends to become smaller, sometimes remaining a four cusped crown with a diminutive distolingual cusp, and sometimes three cusped with the distolingual entirely absent.

The crowns of the lower teeth, while generally having a similar design to those

of the upper, are differently adapted to perform their particular function in the process of occlusion during mastication. The lower teeth are a part of the mandible, and so of the active driving force in the process of mastication. The upper teeth are the recipient of the force. The whole picture of the upright position of the crowns, the relation of the crowns to the roots, the arrangement and direction of the roots, show them to be squatly and firmly planted to receive the force, even as the human being would assume a posture with the legs spread apart and feet firmly planted on the ground, his body erect, waiting to receive an opponent charging against him. On the other hand, when the football player makes his charge, the body is bent forward, the legs are rather close together; suggesting the position and contour of the lower teeth.

Their crowns generally are inclined toward the lingual aspect in relation to their roots, and the roots are formed and arranged accordingly. The crowns of the lower anterior teeth do not appear, in their position in the mouth, to have a lingual inclination in relation to their roots. That is merely an illusion due to the position of the whole tooth in relation to the mandible, in that its central axis is inclined outwardly toward the labial aspect. The lower incisors are very delicate and very graceful in their appearance. They conform to the general pattern of four lobes, of which three are labial, and one lingual. The same general landmarks are to be noted: convergence of the approximal walls toward each other in the direction of the cervical line and convergence of the approximal walls toward the lingual aspect.

As has already been noted, the landmarks on the lingual aspect are lacking, because they do not need the defensive mechanism of marginal ridges and fossae, noted on the lingual surfaces of the upper anterior teeth; for the lingual surfaces of the lowers play no part in the active function of mastication. The lateral incisor is somewhat larger than the central in all measurements. Its distal surface is convex in the cervico-incisal direction, while the distal of the central incisor is practically flat.

*The Lower Cuspids.*—The lower cuspid presents a number of difficulties, and seems to be one of the most difficult teeth to reproduce. These difficulties are dissolved when a careful analysis is made of the arrangement of the primary parts and their individual contours. Of the three labial lobes, the centrolabial, as in the upper cuspid, occupies about half of the mesiodistal diameter, and is somewhat longer than the mesial or distal lobes. It is not nearly so prominent labially in relation to the other two, showing a lesser convexity of the labial surface in the mesiodistal direction.

The distal lobe, while shorter than the mesial, is wider mesiodistally than the mesial, and bellies out distally toward the first bicuspid. The mesial surface is straight in its cervico-incisal direction, and may be noted to be rather continuous with the mesial aspect of its root. Of the two incisal arms, the mesial is rather short, partly because the summit of the centrolabial lobe is only slightly longer than the summit of the mesial, and partly because the mesial lobe is rather narrow, making the distance between the two summits rather small. The distal arm therefore, is considerably longer. The bellying out of the distal surface is in the incisal half of the crown length; in its cervical half, it suddenly becomes concave as it terminates at the cervical line. Its lingual aspect is rather free of markings, except those indicating the coalescence of parts. When the lower anterior tooth is

seen out of the mouth, a most graceful curve can be noted, describing the whole labial aspect of the tooth, from apex of root to incisal summit of crown.

*The Lower Bicuspids.*—The general peripheral outline of the lower bicuspid crowns is very different from that of the upper bicuspids. The general outline of the upper bicuspids may be described as quadrilateral, the approximal sides converging slightly toward the lingual aspect. The general contour of the lower bicuspid may be described as circular. The segments and landmarks fit into a circular pattern, instead of a quadrilateral. The lingual inclination of the crowns is most marked with the bicuspids owing to the "bending over" of the buccal surfaces. The inclination of the buccal surface begins at the junction of the cervical and middle thirds, and ends in the summit of the buccal cusp, and the summit of the buccal cusp almost approximates the central axis of the tooth.

The landmark already referred to as regards the passing of the bisector of the buccal cusp angle through the apex of the root proves to be very helpful in determining the relation of the crown and the root. In the first bicuspid, the development of the lingual lobe is usually not very marked, the buccal lobe remaining very bold and appreciably longer. The pattern of the occlusal surface can be identified with the general pattern already familiar.

Usually, the intercusp space is eliminated by an overcalcification of the cusp ridges, bridging the buccal and lingual cusps with a band of enamel, called the transverse ridge. The central groove may be traced traversing the transverse ridge, and descending mesially and distally to the usual cusp depth. From these points arise the mesiobuccal and mesiolingual, distobuccal and distolingual grooves. The marginal ridges and the triangular fossae are again noted in their usual anatomic positions. The planes of the buccal cusps are usually fuller and somewhat convex, while the lingual eminence appears as little more than a large well-rounded tubercle.

The centrobuccal lobe is considerably more prominent, occupying about half of the mesiodistal diameter, the mesial and the distal lobes being subdued, and dividing the remaining mesiodistal diameter between them. The crown of the lower second bicuspid is somewhat larger than the crown of the first. Its chief interest is a duplication of lobes lingually, producing a three-cusped tooth, two lingual and one buccal. The lingual cusps usually develop to the length of the buccal, and begin to assume the character of the buccal cusps of the upper molars. In most other respects, the general pattern and arrangement of parts is similar to that of the first, with the exception that the transverse ridge is rarely in evidence.

The variations in form of the lower bicuspids are so numerous, so sharp and extreme, that they may be specifically grouped into several typal forms.

It is difficult within the limits of this paper to describe them all, but a number of typical variations of the lower second bicuspid may be pointed out.

These variations are produced for the most part by a change in the course of the central groove, and in the position of the linguo-occlusal groove. In one type, the central groove is rather straight in its mesiodistal direction. From it radiates the linguo-occlusal grooves, dividing the lingual lobes, so that the mesiolingual is wider mesiodistally than the distolingual.

In another type, the central groove consists of two parts, at an angular relationship of approximately 100 degrees, with the point of the angle toward the

lingual aspect. From this point radiates the linguo-occlusal groove, dividing the lingual lobes into approximately equal parts. In still another type, the central group is convex, with its convexity pointing lingually. The linguo-occlusal groove radiates from it at a point distally from the center, which makes the mesiolingual lobe wider mesiodistally than the distal lobe.

*The Lower Molars.*—The lower first molar, like the lower second bicuspid, is made up of five primary parts. The three buccal lobes spread out to form three individual elevations or cusps. The general contour of the occlusal surface may be described as that of an irregular trapezoid, with its mesiodistal diameter, buccally, wider than its mesiodistal diameter lingually. An interesting observation is that the lingual cusps very definitely resemble in type the buccal cusps of the upper molars, and the buccal cusps resemble the distolingual cusp of the upper first molar as they are usually well rounded or convex.

Again, I take the liberty to suggest some changes in terminology to retain the pattern presented, and to make for somewhat more clarity. The three buccal cusps, I suggest calling, respectively, the mesiobuccal, the centrobuccal and the distobuccal, and the developmental grooves separating them, the mesiobucco-occlusal and distobucco-occlusal grooves.

Of the three buccal lobes, the mesiobuccal occupies about half of the mesiodistal diameter; the centrobuccal, about two-thirds of the remaining half, and the distobuccal, the remaining third. The central groove in its course describes a sort of shallow "W," with the base of the W facing buccally. The linguo-occlusal groove radiating from the central point of the W divides the lingual cusps into approximately equal parts. The mesio-lingual cusp is usually slightly longer.

The mesiobuccal and mesiolingual, distobuccal and distolingual grooves run in the direction of their respective point angles. Marginal ridges and the triangular fossae may be noted in the usual locations. Buccolingually, the diameter is greater mesially than distally, owing to a rather marked sloping away of the buccal surface toward the distal aspect.

In the lower second molar in its typical form, the distobuccal cusp is dropped, a four lobed or four cusped tooth resulting, irregularly quadrilateral in outline. The lingual cusps resemble the pattern of the buccal cusps of the upper molar, and the buccal cusps resemble the pattern of the distolingual cusps of the upper molar. The central groove runs rather straight across in a mesiodistal direction, dividing the lingual from the buccal into about equal halves, and the linguo-occlusal and bucco-occlusal grooves join as they intersect the central groove, dividing the mesial from the distal portions into about equal halves, thereby forming a cross. From the terminal ends, mesially and distally of the central groove, the spillways radiate, and again the marginal ridges and the triangular fossae, in their usual position.

The lower third molar is either a typical first molar in pattern or a typical second molar in pattern.

So much for the symmetrical outline of crown forms, sketchily described with the idea of establishing a pattern more or less applicable to all of the teeth.

### VARIATIONS AND ANOMALIES

Variations of crown forms are very numerous. Many attempts have been made to classify the crown forms into types. These classifications, while never so expressed, were really attempts to

classify the variations. Failure of the existing classifications, I believe, is due to the fact that (1) all of the conceivable variations of crown forms were not allowed for, and (2) all of the observations were made at random after certain changes had taken place from all of the forces at work during the masticatory function.

One classification now obsolete is the so-called "temperament grouping," the nervous tooth, sanguineous, bilious and lymphatic. J. Leon Williams, who is responsible for relegating this classification into the discard, is at the same time responsible for another classification equally inadequate. The temperament grouping took into consideration only the anterior teeth. Williams bases his classification only upon the directions taken by the mesial and distal borders of the labial surface of the upper central incisors.

In his first grouping, the approximal borders are parallel in their course. In the second grouping, they converge toward each other in the direction of the cervical line. In the third grouping, the distal borders describe a double curve in their course. Dr. Williams offers this classification, not only for modern Europeans, but also as a constant for all races including primitive peoples and primates, thereby hoping to establish, through the courses of the approximal borders of the labial surfaces of the upper central incisors, definite evidence of the evolutionary theory.

Dr. Williams' observations are not based upon crown forms prior to, or immediately after, their eruption; nor is he taking into consideration the changes from incisal and approximal attrition. Obviously, if the incisal third of the central incisors is worn away, the outline and the course of the approximal borders will appear entirely different from when observed upon the fully formed crown. Obviously, with lateral attrition of the approximal surfaces, the contours of the approximal borders will also become appreciably altered.

These observations, are, I believe, sufficiently striking to raise an issue with Dr. Williams' point of view, but I am engaged in answering him at somewhat greater length in a separate paper.

It is not my desire or intention to enter the field of controversy in the studies of comparative dental anatomy. The observations and classifications recorded are entirely on the basis of physical evidence in the human dentition. Controversial aspects, more particularly with relation to the concrescence theory, do not, I believe, interfere with the present observations and classifications. Whether the human tooth, from the standpoint of paleontologic evidence, has developed through the ages from a primitive single cone, or whether, as Gregory maintains, the human tooth has been formed through the ages as the result of a series of specialized modifications due to environmental needs, does not interfere with the physical evidence in the observation of the human tooth, in that the human tooth at least appears to be a unit of individual segments with evidence of union between them. The histologic evidence in the development and growth of the human tooth appears to strengthen the idea that its development begins with a number of individual centers, which seem to form independently, merging toward each other as their formation is completed.

This evidence, with this conclusion, does not necessarily contradict Dr. Gregory's point of view. In his explanation of the evolution of the human tooth, his logic particularly appeals to me, because it fits in very well with the general evolutionary doctrine. Nor will the addi-

tional evidence listed under anomalies particularly contradict Dr. Gregory's point of view, for he seems to anticipate them on the basis of endocrine disturbances within a particular individual, as against the reversion to the primitive single-cone theory.

Variations must be classified as natural and acquired. An important distinction must be made between these two groups. The acquired variations are the result of external irritants, whether bacterial, chemical or mechanical, and have nothing to do with the inherited development of the crown form. These variations, which in themselves are very numerous, and are not to be discussed in this paper, must be carefully distinguished from the natural variations.

Natural variations are predetermined and congenital, and are best observed after the crown is completely formed, either prior to eruption or immediately after eruption. What the active factors in the formation of natural variations may be is still very much a matter of speculation. The laws of heredity, of course, play an important part in the explanation of a large group. Endocrine disturbances may be responsible for some; the mechanical resistance or absence of mechanical resistance during the calcification of the crown may be a very likely explanation for a good many. Much work is still to be done in this direction. Any attempt to classify forms into types must prove futile, because of the infinite variations found, unless such a classification prove helpful for practical purposes in designating artificial teeth from supply houses.

The physical classification of square, oval or triangular; narrow or wide, short or long, may, for such purposes, prove adequate, but is on the other hand obviously quite inadequate in a study of variations. The answer must be found in the classification of the types of variations to be found, and in order to accomplish this, some attempt must first be made to observe the constants. These constants can be found in the basic form of the crown, the modifications of which are the variations produced. This basic outline form has already been discussed under "Symmetrical Tooth Form."

To sum it up, the constants to be found are: (1) the number of segments or lobes comprising the completed form of the crown; (2) the form and contour of each segment; (3) the arrangement of the segments, and (4) the relation that one segment bears to another.

The natural variations associated with these constants may be classified as:

1. Any proportionately greater or lesser development of all of the segments, retaining the same number, same arrangement and same contour, with the same relation between all of the segments, merely a difference in size resulting.

2. A disproportionate development of the segments, containing the same number, the same arrangement and the same relation between the segments, but having variations in the form of each segment, which results in variations in dimensional relationships of the surfaces of the crown.

3. Accentuation or overcalcification of parts of individual lobes.

4. Imperfections or deficiencies in or undercalcification of parts of individual lobes.

With this grouping, all of the conceivable variations may be accounted for. An attempt to list all of the variations that I have observed and fitted within their respective groups is material for another paper, and is included in my textbook. It will therefore suffice to give individual illustrations.

The first two groupings are more or less obvious. In the first grouping, we find teeth more or less identical in general character, but different in size, retaining the same proportions in all directions.

In the second grouping, we find teeth which vary in their dimensional relationship. The width of the lobes may remain the same, but there is underdevelopment in length. This changes the proportion between the mesiodistal diameter and the cervico-incisal. Or they remain the same in length and show underdevelopment in the width of the individual segments, a longer and narrower tooth resulting.

Tubercles found on the cingulum of the upper anterior or on the marginal ridges of the posterior teeth and on the point of union between lobes are variations to be included within the third grouping.

Transverse ridges or overcalcification of the base of cusps at the point of coalescence between buccal and lingual lobes also fit into this grouping; and similarly, transverse ridges noted upon the lingual surfaces of the upper anterior teeth, the result of an overdevelopment of the centrolabial lobe. This type of overcalcification is also responsible for many variations in the crown forms of the lower bicuspids. Pits and fissures belong to the fourth grouping, and are evidence of the lack of improper union of two or more segments.

Pits and fissures, which have a very important bearing on our operative procedure from the standpoint of preventive dentistry, are now receiving a great deal of attention through the efforts of the Hyatt Study Club. Pits and fissures are conceded to be a definite invitation to bacteria, with the subsequent production of caries. In an effort to indicate something of their danger, in that they are prone to cause caries, I supplied the term "precarious" fissures. Smooth depressions usually found upon the labial surface of anterior teeth, particularly the upper lateral incisors, are also evidences of undercalcification and apply to the last grouping.

Anomalies are unusual variations of comparative rare occurrence. They too are either congenital or predetermined, or are influenced by metabolic disturbance during the process of calcification. Some of the anomalies noted are a complete absence of one or more of the lobes, as, for example, in the peg-shaped lateral incisors. This type presents a congenital absence of both the mesiolabial and distolabial lobes. On occasion, the upper lateral incisor is entirely absent, congenitally, either on one side or on both.

Another example of undercalcification, resulting in anomaly, is the so-called "Hutchinson" tooth, in which the development of the parts is completely arrested, as the result of hereditary syphilis. This type of anomaly is characterized by an atrophy of all the segments of all of the anterior teeth, including the first molars. This is to be differentiated from a type of atrophic anomaly which develops as the result of some contagious or infectious disease, or general cachetic disturbance at a very early age. Duration of the influence of these metabolic disturbances is usually much shorter than the influence of hereditary syphilis, and, for that reason, not so many of the teeth are interfered with during their calcification. The atrophy will, therefore, be noted only in the case of the anterior teeth and, on occasion, only the incisors. This is an important point in differential diagnosis.

Extreme overdevelopment of one or more of the lobes also results in a type of anomaly included within the fourth

grouping. I have in my possession individual specimens showing overdevelopment, in some cases of only one of the lobes, to practically the size of a small crown.

In another instance, a specimen in which all of the three lobes of the lower central incisor are overly developed, each to the size of a full crown, gives the appearance of three crowns all on one root. Additional lobes, which I have particularly observed on the aspect of the mesiobuccal lobe of the upper second molar, also belong to the last grouping.

DISCUSSION

*James Mark Prime, Omaha, Nebr.:* Dr. Diamond gives us a somewhat different approach to the much discussed subject of dental anatomy. Judging from the beautiful work that we have seen from his hands, we are compelled to give consideration to his method. He studies the tooth crown from a developmental point of view; taking each lobe as a definite part and visualizing the results as these separate parts are united to complete the crown. His method has value in clarifying the presence of some tooth-form characteristics that could not, perhaps, be accounted for so easily by other approaches. Any method is good only so far as it is able to assist us in recognizing and reproducing physiologic characteristics. It is not within our province or within possibility to form crowns of teeth after the method employed by Nature. Fundamentally, therefore, we are not so much interested in *how* she does it as *why* she does it. The relative importance of the two may be illustrated by comparing the teeth to other organs of the body. The all-important function of the eye is vision. Would a comprehensive knowledge of Nature's method of developing it materially aid us in correcting the irregularities of this organ? We may have very accurate ideas as to how Nature develops other organs and be ill prepared, with that knowledge alone, to restore their functions when they become impaired or lost. Function, therefore, forces its way to the front as the major consideration with all organs of the body. Since form plays an important rôle in dental functions, we find ourselves dealing with a major subject in dentistry. The functions of the dental organs of man are many. The principal one, mastication, is effected through occlusion. The occlusal surface is the business end of the tooth. Any form characteristic that aids in this function is an asset and of first importance. Any efforts at restoring these forms which fail to aid or interfere in this function are a menace and a liability. Dr. Diamond well says, "Anatomic differences are most marked in crowns of teeth," because, as he states, of a variation in specialized function. "Marked as these differences are, there are a series of landmarks common to the crowns of all teeth. Some to the upper, others to the lower and some to the particular tooth." Variation is the law of Nature. It is dangerous to lay down rules or take the position that a certain characteristic is constant. Rules are ill applied to organs so variable in their forms. The best rule is that there is no rule. On the other hand, we find characteristics occurring so regularly as to unmistakably point to the fact that Nature intended them as functional attributes. Studying tooth form from a functional point of view offers a basis for easy comprehension. Many studies in the past have lost much of their value, because, as Dr. Diamond states, they were made on extracted teeth, many of which were deformed through caries and wear. It is perfectly obvious that, if we desire to arrive at a common, scientific understanding of this subject, we must gather our facts from teeth on which there are no marks of mutilation from caries or deformity from wear. We should make our observations from these teeth more than from lectures, carvings, essays or textbooks. Dr. Diamond uses the term "plane" in reference to the occlusal surfaces of the bicuspids and molars. These surfaces as they come from the hand of Nature are ridged, tuberculated and curved. Planes are to be found on them only after they have been deformed through occlusal wear. These surfaces, before they are worn, meet each other, at small points, when the jaws are closed. This can easily be demonstrated if we place a piece of carbon paper between the teeth of a young person and ask him to close. Small dots will appear on the occlusal surfaces where the occlusal contacts were made. Nature was jealous of this form and made a heroic effort to maintain it by building these surfaces of the hardest tissue known, enamel. To further perpetuate those forms, she so

arranged the rods that wear occurs on their ends. Flat surfaces are rarely if ever observed on tooth crowns before they are subjected to wear. The surfaces of the teeth are built on curves. They harmonize with the ideas of the great artist who said, "The law of beauty is curve upon curve." It is time that the dental profession recognize "inclined planes" as acquired deformities, and we should refer to them in our literature and textbooks as such. The lower bicuspids and molars are inclined lingually. At the cuspid, the line of inclination changes, and the incisors incline labially. The contact points between the lower bicuspids and lateral incisors are located at the middle of the incisal third of the tooth, while the contact points of the other anterior teeth are at the incisal edges, forming a continuous blade or cutting edge. This is in harmony with the designed function of these teeth. Dr. Diamond sees no function in mastication through the developmental grooves in central incisors. In this, I would concur, but when he applies this to the bicuspids and molars, he does Nature and the truth a gross injustice. Developmental grooves aided by supplemental grooves play a most important rôle in function in all bicuspids and molars. Gateways, reliefways and spillways are provided by them. If I understand Dr. Diamond correctly, he tactfully sees one serving him for what he calls a "logical spillway." I might venture the suggestion that spillways are not developed, maintained or made to function by the rules or laws of logic, but rather by laws of biology and physiology. Dr. Diamond thinks that he senses a disagreement with me on this. His dispute is not with me but with Nature. The spillways are there persistently. They do not, as he would imply, divert food into the interproximal spaces. They aid strongly in preventing that very thing. They are not worn away until the cusps are lost through wear. Would he contend that cusps have no function because they are many times lost through wear? They are not confined to the upper bicuspids, but are consistently present on other teeth. Their presence, in some degree of development on most teeth, and their functions are too well understood to justify going more deeply into the subject here and now. Dr. Diamond offers for our consideration some new dental terms. If they will aid us in a better understanding of this important subject, we are for them. The essayist's remarks on the typal forms as postulated by J. Leon Williams agree with those of my own. His logic is clear and square with the facts, as I see them. Dr. Williams claims to have discovered a definite relation in face form with upper central incisor form. My observations extending over many years have offered no proof for such theory.

*Austin F. James, Chicago, Ill.:* Dr. Diamond's review of dental anatomy calling attention to types of tooth formation is of interest to the periodontist, because he realizes, more than any one else, what Nature has done to protect the delicate supporting structures. If, in Dr. Diamond's clinic, he is able to demonstrate some definite method to assist the general operator in reproducing natural tooth forms in all restorations, he will indeed have added valuable information to the profession. I have had the opportunity of observing numbers of cases coming from the hands of a few operators who have the ability to reproduce tooth form in fixed bridgework, as well as in the construction of large and small inlays. I realize how much better the supporting structures react where this idea has been carried out. The periodontist is confronted with many cases in which there is a slight malocclusion. Or, as Dr. Tishler has said, "occlusal habit neuroses" have developed pathologic conditions in the supporting structures of otherwise well formed arches and perfectly formed natural teeth. Many of these patients are past the age when orthodontic correction could be employed. Relief must be secured in some manner, so the periodontist has attempted to balance the occlusion by grinding the natural teeth. In cases in which questionable judgment has been used, much mutilation of the teeth has followed; which has caused some conscientious dentists to hesitate in attempting this procedure. My own respect for the natural tooth has led me to spend much time in attempting to solve this problem. My whole effort has been to reproduce the natural tooth form in all worn opposing teeth, and the relief that can be obtained is really quite satisfactory.

*Dr. Diamond (closing):* Dr. Prime seems to group all cuspal forms as of one type, the rounded or convex eminence, but careful examination discloses three definite types all of which can be seen on one occlusal surface, that of the upper first molar. Surely, the buccal cusps are not the same as the mesiolingual cusp, nor has the mesiolingual cusp

the same character as the distolingual. The buccal cusp is made up of two irregular quadrilateral planes at a relationship of 120 degrees, and I prefer to speak of them as planes rather than as inclined planes. The mesiolingual cusp definitely presents a depression or concavity and only the distolingual is rounded or bulbous. That these planes of the buccal cusps, at the time of eruption, present ridges or elevations which are soon worn down by the stress of mastication is no evidence that these elevations or ridges are intended to remain. That they have a function, there is no doubt, but this function, similar to that of the terminal ends of the labial lobes of the upper central incisors, is to aid the tooth in its eruption. The incisors are soon worn down by the stress of mastication after the crown's eruption, leaving a sharp incisal edge which Dr. Prime, I am sure, would agree is more fitted for its specialized function of incision. Dr. Prime, in restoring the incisal surface of an adult upper central incisor, would not think of restoring a triple lobular elevation because, I am sure he must agree, their function ceased with the eruption of the crown. Similarly, the elevations upon the planes of buccal cusps are intended to aid the crown in the process of its eruption. They seem to disappear all too soon in the normal human mouth to make one believe that they have any other function in the process of mastication. Regarding the question of spillways, Dr. Prime and I do not disagree about their importance; we merely disagree about their location. A continuation of the central developmental groove across the mesial marginal ridge, sometimes running the length of the entire mesial surface, is not, to my way of thinking, a spillway, because: 1. We do not find it traversing the marginal ridges of all posterior teeth, though we do find it constantly traversing the mesial marginal ridge of the upper first bicuspid. 2. The break across the marginal ridge must necessarily tend to direct the masticated foods in the interproximal space, and I do not believe that Nature could have, at the same time, devised an elaborate defensive mechanism, such as the marginal ridge and point of contact to prevent masticated foods from entering the interproximal spaces, and then defeat its purpose by designing a spillway in the location that would permit them to do that very thing. That we find variations in crown forms which are conceded as defects, there is no doubt. These defects are chiefly found in those regions of coalescence between cusps, particularly between the three buccal lobes and the single lingual lobe of bicuspid teeth, and between all of the four lobes in the molar teeth. There also seems to be no doubt that the more evident the break in the region of coalescence, the more evident is the lack of completed development. On the other hand, the grooves usually spoken of as supplementary are, to my mind, the important grooves as far as spillways are concerned, and for that reason I speak of them as the logical spillways. Their course leads the masticated foods in the direction of the respective point angles, either in the vestibule of the mouth or in the mouth proper and away from the delicate supporting tissues.

# THE NATIONAL BOARD OF DENTAL EXAMINERS

By J. V. CONZETT, D.Sc., D.D.S., F.A.C.D., Dubuque, Iowa

EVER since its existence as a profession, dentistry has labored under the disadvantage of having the professional activities of its members limited to the particular state in which they are licensed to practice. It has not been possible for a practitioner to move from one state to another without being compelled to pass the licensing examination of the state in which he wished to practice.

This procedure became necessary as a matter of protection because the state dental laws and the qualifications for practice were so varied in the different states. The dental colleges required such different entrance, promotion and graduation qualifications that it became imperative for the states with high professional ideals to protect themselves from the influx of practitioners from states and institutions having lower standards for practice.

It has long been the desire of the leaders in the profession to relieve this anomalous condition and bring about a unification or standardization of educational and licensing requirements, which would permit the graduate dentist qualified to practice in one state to practice in any state in the union. To this end, various methods and suggestions have been considered and some of them put into practice in a limited manner, but none of them have been effective. The most noted effort in this direction was that of interstate reciprocity, which failed for the reason above stated; namely, because all practitioners were not equally qualified, either in cultural or professional attainments. Therefore, not all states were willing to enter into agreements to admit dental graduates from other states to practice without examination.

Recognizing the chaotic condition of affairs in dental education, the national organizations entered into an agreement whereby the Dental Educational Council of America was constituted by the appointment of five members from each of the parent bodies, the American Dental Association, the National Dental Examiners Association and the American Association of Dental Schools. To this council was delegated the task of harmonizing professional school entrance requirements, promotion conditions and graduation qualifications.

This council has been working at its appointed task for twenty or more years, with the result that the educational standards in the colleges of the country are greatly advanced and more nearly equalized in every particular. Many of the weaker schools have been forced to retire from the field of dental education; many others have been strengthened either from within by additional physical and teaching resources, or by a merger with other schools. In the meantime, the Educational Council has steadily raised its requirements for Class A schools until, at the present time, the educational

requirements in dentistry closely approximate those of the medical profession.

It is manifest, then, that the original conditions which demanded that the qualifications to practice dentistry be determined by the various states are not now present as in former years. Now, every student of dentistry must have had four years of high school preparation and at least one year of collegiate work in order to matriculate in any dental college in the United States. He must have four years of professional training of a specified type in the dental school in order to graduate. He must then pass a state board examination before he can become eligible to practice in any state, and can then practice only in the state the board examination of which he has passed.

In view of the advancement of the status of dental education as presented in our colleges, and the further fact that the graduate is carefully viséd by the state boards, it seems to be opportune to formulate some method by which the dentist may present himself to some centralized constituted authority, the certification by which will enable him to practice his profession in any state in the union. In pursuance of that idea, the American Dental Association, after careful study of the situation, has invited the National Association of Dental Examiners and the American Association of Dental Schools to nominate five from each body to the American Dental Association who, with five members from the American Dental Association membership and approved by the House of Delegates, will constitute a national board of dental examiners. Accordingly, the nominations were made at the Minneapolis meeting, and the House of Delegates confirmed these nominations and thereby created the National Board of Dental Examiners under the auspices of the American Dental Association, to which they are responsible and from which they receive their authority and financial support.

The board, as at present constituted, is as follows: from the National Association of Dental Examiners: A. H. Reynolds, George E. Haigh, M. J. Loeb, H. J. Feltus and O. E. Jackson; from the American Association of Dental Schools: W. H. G. Logan, A. R. McDowell, Delos L. Hill, A. W. Bryan and Charles R. Turner; from the American Dental Association: L. Pierce Anthony, A. C. Wherry, H. W. Nelson, J. Franklin Cook and J. V. Conzett.

In addition to the above-mentioned names, the Surgeons-General of the United States Army, Navy and Public Health Service have been requested to cooperate with the dental organizations in this movement. They have generously consented to do so and have appointed as their representatives Robert T. Oliver, from the Army; Paul G. White, from the Navy, and G. T. Messner from the Public Health Service.

The above mentioned men have held several meetings and have regularly organized the National Board of Dental Examiners pursuant to the instructions of the enabling act passed by the House of Delegates at the meeting of the American Dental Association convention in Minneapolis in 1928. J. V. Conzett was elected chairman, and A. H. Reynolds, secretary, and they, together with Drs. Logan, Turner and Loeb, constitute the executive committee.

The Board is constituted along the lines of the National Board of Medical Examiners, whose secretary, Mr. Eltwood, has been of inestimable service to the dental board in his advice and assistance.

The purpose of the Board is to issue a certificate of examination to each successful candidate that will readily make available to him the license to practice in any state, by virtue of the high standard of the examination.

It is the intention of the National Board of Dental Examiners to hold its examinations in three parts. The first part will be known as the junior examination, intended to cover only the fundamental professional subjects, and it is the purpose of the Board to hold the first examination in part one sometime next December. The second part, the senior theoretical examinations, will be held sometime in the middle or latter part of May following the junior examination.

All of the examinations will be held at the same time, the members of the subsidiary examining board being selected from the state boards of dental examiners of the states near the examination centers. The first two parts, being theoretical, will be held in various centers, to be selected in the future, and will be held concurrently, so that it will be impossible for any student to obtain advance information from any one who has taken the examination.

Supervisory boards will be formed to help conduct these examinations from the various state boards of dental examiners in the states near the centers in which the examinations will be held. Each board will be requested to send a representative, who will be a member of the supervisory board at that examination. This will expedite the examinations, and will, in addition, place all examinations under the direction of the various state boards of dental examiners, the National Board simply supervising and directing the manner and methods of examination.

The final examination, part three, the practical one, will be under the direction of subsidiary boards which will be made up of members of the various state boards. For example, if an examination is to be held in Chicago, the boards from the surrounding states, Indiana, Wisconsin, Michigan and Iowa, will be requested to send representatives to that board, and they will constitute the board to conduct the examination. The chairman of the board will be a member of the National Board. In this way, the state boards would have control of the examinations and would be able to pass directly on the qualifications of the candidates for certification.

The questions to be submitted to candidates for the theoretical examinations will be selected from those presented by the heads of departments in our various dental colleges, who will be asked to present a list of such questions, together with a study of the questions that are being asked by the various state boards. It is the object of the National Board to make the examinations as rigid as those of any state, but to have them fair and comprehensive. It is to that end that the assistance of the various heads of departments of the different colleges will be asked to cooperate in the formulation of the questions. An examination, to be of the greatest value, should not be made up of "catch questions," but should comprise questions that fairly seek to determine the mental and technical ability of the candidate.

The candidate who passes the junior examination (Part 1) will be eligible for the senior examination (Part 2), and when he passes Part 2, he will be eligible to take the final practical examination (Part 3). No student who has failed in his college work will be eligible to take any examination. Every candidate there-

fore will be required to present a certificate from his school authorities attesting his eligibility to take part in the examination.

The advantage to the student of the certificate of the National Board will be the prestige afforded by the possession of the certificate of the national examining authority, with the ultimate advantage of the privilege to practice in every state in which the certificate is recognized. The final authority, in that respect, will reside in the individual state boards, and they will have to pass on the qualifications and credentials of the candidate before acceptance of the certificate.

At present, there are three or four state boards who have signified their willingness to accept the national board certificate and more will do so as soon as they are able to obtain permission from their legislatures. The laws of some states will have to be modified to enable them to recognize the certificate, but if the state societies and the profession want it, they will be able to get the desired legislation.

The medical board has been fifteen years obtaining the cooperation and approval of thirty-five states, but as they have blazed the trail, it should be much less difficult for the dental board to gain general approval. The fact is that we are simply following their lead, walking in their footsteps and endeavoring to avoid their mistakes; and, being guided by their successes, we should be able to progress much more rapidly than they have. In this manner, one of the greatest handicaps of dentistry will be eliminated, and we shall be able to advance all the more rapidly. Obstacles are bound to arise owing to the objections that will be raised by those having personal axes to grind, but, in the end, right and efficiency will prevail.

It is the intention of the Board to ask permission of the various schools for a member of the Board to go before the student body and explain to them the desirability of every student's taking the examination and also to explain to them the method of procedure for those who wish to take the examinations.

The dentist in practice at the present time will have the same opportunity to pass the examination that the graduate student possesses, and his preliminary and professional education will be viséd according to the educational requirements of his graduation period. The present status of the practitioner will be given the same consideration that is given it by the state boards at the present time, and at no time will the National Board attempt to assume any superiority over the state boards. Their ultimate authority is recognized and it is hoped to work with and through them to the solution of this problem.

# IMPACTED MANDIBULAR THIRD MOLARS*

By J. P. WAHL, D.D.S., New Orleans, La.

THE term "impaction," according to the latest edition of the American Medical Dictionary, is derived from the Latin *(impactio)*, meaning the condition in which the tooth is embedded in the alveolus so that its eruption is prevented.

The term "impacted," according to the same authority, comes from the Latin *(impactus)* and means closely lodged.

A tooth, then, is spoken of as being impacted when its eruption is partially or completely obstructed by some other tooth or a tooth root, or by dense bone.

The lower third molar might be entirely embedded in the substance of the bone and remain there for a number of years with or without any apparent pathologic manifestations.

Of all the teeth, the lower third molar is the one most frequently found impacted, the upper third molars being next in frequency and then the cuspids. In fact, any tooth in the dental arch may become impacted.

## CAUSES

Impaction of the lower third molars may be caused by the previous malposition of other teeth or of the tooth germ itself, or may be due to the development of the root while the crown advance is retarded, which causes the expulsive force produced by root formation to be lost. The expulsive force being lost by some obstruction, the impacted tooth root often becomes distorted and bulges in an abnormal shape. This bulging and distortion will often cause the impacted tooth root to encroach very close to the mandibular canal, but in most cases Nature seems to protect this important part of the anatomy and the root will form around the nerve instead of growing into the canal.

The irritation arising from the efforts of a tooth to disengage itself or to overcome the resistance to its eruption often causes an active formative reaction in the pericementum, which results in a hypertrophy of that structure.

The pressure on the bone causes a condensing osteitis, and the bone becomes more dense and obstructive, and less vascular, making the removal of the tooth more difficult the longer it is left in place. For this reason, if for no other, these teeth should be removed at as early an age as possible.

Acute infectious fevers, such as scarlet fever and measles, very often cause a deposit of dense bone in the path of the erupting mandibular third molar; which causes the crown of the tooth to be deflected, and the tooth becomes impacted.

Inflammation of the jaws brought about by caries or other conditions; traumatic injury from accidents to the mandible in early life; contraction of the arches produced by excessive mouth

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breathing due to nasal obstruction from adenoids or a deviated septum, and thumb sucking may also cause impaction of the lower third molars.

Too early extraction of the bicuspids may cause a malposition of the permanent molars and finally cause the mandibular third molars to be impacted.

Orthodontic treatment, if carelessly employed in the child, will cause the mandibular third molars to become impacted.

SYMPTOMS

Impacted third molars may be present in the mandible for many years without giving the slightest appreciable local or systemic symptoms. But a great majority of impacted lower third molars often produce intermittent spasms of the masseter muscle. Owing to the anatomic arrangement of the tissues in the region of an impacted mandibular lower third molar, inflammation may extend until the surrounding muscles and glands are involved and may cause a temporary ankylosis, which may be of a sufficient degree to cause a complete fixation of the mandible.

Swelling may be confined to the tissues in the region of the impaction and may also extend to the parotid and submaxillary glands. The pain in some cases is continuous and very severe, while in others it is only felt on opening and closing the mouth.

In adults impaction of the lower third molars is the frequent cause of reflex pain, epilepsy, chorea, facial spasm, dementia praecox, mania, paralysis, sensory alterations, neuralgia, paroxysmal pains, insomnia, chills, flushes, muscular twitching, melancholia, rapid pulse and fever. These patients often complain of pain across the front of the head and around the temples; behind the head and around the temporomaxillary articulation, and in the eyes and ears.

The presence of impacted lower third molars may cause severe physical disturbances by exerting pressure on the surrounding nerves, or may cause severe neuralgic pains. These teeth may lie in contact with an important nerve branch and become a source of irritation to the surrounding nerves, acting as an exciting cause of trifacial neuralgia.

LOCAL EFFECTS

The most common effect, then, attendant on impaction of the lower third molars is trifacial neuralgia, caused by an irritation of the mandibular nerve itself, from pressure.

Impaction of the lower third molars often gives rise to heavy rheumatic pains about the side of the face and jaws.

Symptoms of maxillary periostitis, heavy gnawing and dull throbbing pain, with a more or less engorgement of the tissues, are noted as an accompaniment of impaction of the teeth.

I have had patients, and no doubt you all have, who have come to the office complaining of a heavy gnawing pain in the mandible and giving a history of having had all the fillings on the affected side removed, without any relief, only to find, on roentgen-ray examination, that they had an impacted lower third molar.

Thoma, in this book on oral abscess, says that the presence of impacted teeth may cause abscesses, when they are so interlocked that it is impossible for them to come to the surface. Such teeth may lie dormant for several years, but at any time may suddenly become associated with active pathologic conditions when exerting pressure on the tissue toward which they grow. It seems to be a physiopathologic law that any abnormal pressure in the body causes resorption of the

part most easily dissolved. This, in turn, forms an area of low resistance and is liable to infection, which may occur from a blind abscess on a neighboring tooth or may be carried through the blood.

Quickly forming cysts of the mandible are often found to contain an impacted tooth either fully or partially formed; this evidently being the center of irritation from which the cystic formation had its origin.

Infection of the mandibular canal may be established by the incomplete root development and pathologic conditions that arise from impaction of the teeth. Infection of the mandibular canal may also be produced by pressure of the impacted tooth against the root of the second molar, absorption of the root and death of the pulp of that tooth resulting.

Impacted lower third molars may set up functional nervous and mental disorders without causing any local symptoms.

Henry Cotton, of Trenton, N. J., in his book entitled "The Defective Delinquent and Insane," reported many interesting cases of insane patients being cured or greatly benefited by the removal of impacted and infected teeth. Dr. Cotton devotes a chapter to this subject.

### TECHNIC FOR REMOVAL

The technic for the removal of impacted lower third molars is as varied as the colors of the rainbow. Any special technic that might do well in the hands of one operator might be very burdensome in the hands of another. It is, therefore, left to each operator to select the technic that will answer best in his hands and the one that will permit him to take his time and rather dissect the tooth out in a clean surgical manner with the minimum amount of traumatic injury to the patient or the surrounding parts, always bearing in mind that brute force should not play any part in the removal of an impacted lower third molar.

In my hands, I have found the use of the mallet and chisel, with the aid of exolevers, most advantageous.

Before attempting the removal of an impacted lower third molar, the operator should, of course, have a thorough knowledge of the anatomy of the surrounding parts and should have made a complete and thorough diagnosis from a good roentgenogram. He should also obtain a complete history of the patient's physical condition. Any one who would attempt to operate without first obtaining a good roentgenogram is unwise, incautious and unprepared.

In cases of partial impaction in which a part of the tooth has come through the gum and the gum tissue over the remaining part of the tooth has become inflamed from the pressure exerted on it during mastication, it is imperative to reduce the inflammation before removing the tooth. I have seen some serious consequences when this condition had been neglected. Owing to the anatomic arrangement of the tissues in this region, the inflammatory process often extends to the tonsils and glands, causing an edema, which is very often hard to handle, if it gains headway.

This inflammatory condition can often be reduced by the use of a hypodermic syringe, with a blunt needle, charged with some antiseptic solution or physiologic sodium chlorid solution, care being taken to flush gently between the overlying gum tissue and the crown of the impacted tooth. This is followed by a 5 per cent solution of mercurochrome, 220 soluble. The patient is then advised to use hot irrigations of some good antiseptic and apply the ice cap to the face in the region of the angle of the jaw. A

liquid diet, as nearly alkaline as possible, is prescribed for a few days. This treatment, if carried out for three or four days, will usually bring about the desired results; when the impacted tooth can be removed without fear.

The selection of the anesthetic should be governed entirely by the physical condition of the patient and the condition of the surrounding tissues of the field of operation. I prefer a general anesthetic, given in a hospital, as I find that patients have less swelling and pain when operated on in a hospital under general anesthesia than when operated on under procain, either in the office or in a hospital.

As clean surgery is aspetic surgery, everything about the patient's mouth should be put in a condition as nearly aseptic as is possible before the anesthetic, whether local or general, is administered.

The teeth should be thoroughly cleaned as far as possible, after which the teeth and gums should be thoroughly mopped with a 5 per cent solution of mercurochrome. The face is then wiped with a 70 per cent solution of alcohol, and a suitable cap is placed about the patient's head. If the operation is to be performed in the office, a suitable apron should also be placed about the patient to protect the clothing and keep his hands away from the field of operation. The operator's hands should be thoroughly scrubbed and he should wear a sterile gown.

The anesthetic should now be administered. After anesthesia is obtained, if general, the patient's throat should be well packed so as to prevent blood or other material from escaping into the trachea. This precaution will often prevent otherwise disastrous after-effects.

The cheek being held out of the way by the assistant, an incision is made, with a very sharp knife, along the occlusal aspect, beginning just back of the crown of the second molar, nearer to the lingual than the buccal aspect and extending back and upward between the internal pterygoid and masseter muscles for about an inch or more. An incision is then made parallel to the long axis of the second molar, distad from it, if for a partial impaction, and mesiad to it if for a completely submerged tooth. This incision is carried down on the body of the mandible for about one-half inch or more. The mucoperiosteum is then elevated and held back with a suitable retractor. A sharp chisel of the proper size and shape is selected and, with the aid of the mallet, the osseous tissue is dissected away. (This style of flap allows us at all times to see just how close to the second molar we are working, which is of great value.) After a sufficient amount of bone has been removed, so as to permit easy access to the impacted tooth, a suitable exolever is selected and placed in the proper position and, with a slight amount of pressure, the tooth should be freed from its position.

It might be well to mention that during the operation the blood is removed with a suction machine. After the tooth has been lifted out, great care should be taken to remove all loose pieces of bone and sharp edges. All pathologic tissue is then curetted out. The wound is thoroughly examined and then flushed with a 5 per cent solution of mercurochrome and sutured. I use B. B. silk dermal sutures. After the removal of a partial impaction, I usually use a small dressing of 5 per cent iodoform tape in the wound, but in a case of a deeply embedded mandibular third molar, I suture and close the wound entirely.

It is always a good procedure to take a roentgenogram immediately after the impacted tooth has been released, as this

not only shows us that we have removed the tooth in its entirety but will also show whether any portion of mandible has been fractured.

I am strictly opposed to placing any pain relieving remedies in the wound at the completion of the operation, as I believe they interfere with the normal blood clot and do more harm than good. If the wound should become painful at a later date, any one of the vast number of antipain remedies might be employed. Acetyl salicylic acid, alone or in combination with codein trigemin capsules, may be prescribed to abort postoperative pain.

### POSTOPERATIVE TREATMENT

The patient is instructed to irrigate the mouth, but not until about four hours after the operation, with a warm saline solution or any good antiseptic, and to apply the ice cap to the part. A diet as nearly as possible soft and alkaline is prescribed, and the patient is advised to drink plenty of orange juice and take at least one or two lemonades each day, with about one quarter of a teaspoonful of sodium bicarbonate to each lemonade. A saline cathartic is prescribed.

### DANGERS

The removal of an impacted lower third molar is a surgical procedure and all precautions necessary for surgical procedure must be adhered to. Under conduction anesthesia, the dangers are few.

Hemorrhage may occur and be difficult to control and serious in its results. Fracture of the mandible may occur where pathologic conditions have weakened it to such an extent that any slight force might produce a break. General infection may be produced if careful and aseptic technic is not practiced.

Under general anesthesia, the dangers are far greater. Blood inspired while the patient is in a supine position may easily, if the throat is not packed, drain into the trachea in such quantities as to fill the bronchi and cause death. The inspiration into the lungs of blood and saliva laden with bacteria may produce septic pneumonia. The impacted tooth, suddenly forced out of its socket may, on account of the supine position of the patient, slip down the throat and become lodged in the trachea or bronchi and cause death by suffocation.

Under general anesthesia, the immediate loss of blood may be so great as to weaken the patient, and, if not checked, may result fatally. Shock is not fully eliminated under general anesthesia.

In closing, I should like to impress on each one of you the importance of an early diagnosis of impactions. Do not lead your patients to believe that an impacted tooth can remain without doing any bodily harm because none of the foregoing symptoms have made their appearance, but advise them of the seriousness of the situation and suggest early removal.

1135 Maison Blanche.

### DISCUSSION

*Harry Bear, Richmond, Va.:* Dr. Wahl surveys an extensive field when he discusses impaction of the mandibular third molar, its causes, symptoms and local effects, with technic for removal and postoperative treatment. The etiology is unsolved. Some of the causes mentioned take in almost the entire sphere of dentistry and part of medicine, from the malposition of the tooth germ itself to mouth breathing and faulty orthodontic treatment. I observe, parenthetically, that Dr. Wahl failed to mention just one thing, and that is, the probable effect of diet as an etiologic factor in impaction of mandibular third molars. The faddists would say that this must not be overlooked as one of the possible causes in any deviation from the normal in our human makeup. The question of symptoms is divided into local and general

effects. We are all familiar with the many local manifestations of impaction of mandibular third molars, and we are further aware of the involvements of adjacent anatomic structures. To read his list of general symptoms is like reading a list of the ailments on a bottle of "patent" medicine, whereby it is explained that the contents are a panacea for all human ills. I am not unmindful of the general necessity for and importance of the removal of these teeth, but I am sure that it is not the intention to presume the cure of so many ills, as it is proverbially expressed, from ingrowing toe nails and baldheadedness to various degrees of insanity. Too much importance cannot be placed on making an accurate diagnosis of a case. A complete roentgen-ray examination and careful clinical findings are imperative. It is needless to repeat here the importance of a thorough knowledge of the anatomy of the structures involved. Dr. Wahl directs attention with pertinence to the necessity for reducing acute inflammatory conditions associated with these impacted teeth before operating. This does not mean that every case exhibiting some local inflammation warrants this procedure, but the operator must use his surgical judgment as to whether or not operative interference or palliative treatment is indicated. The surgical technic is discussed with reference to the general principles involved. Many and varied have been the methods advocated in this field. The elements of importance require that there be a minimum amount of trauma and as little disturbance as possible to all adjacent tissues. It is presumed that every facility for the observance of aseptic surgery is employed and that all precautionary measures are utilized in the interest of the patient's welfare. The various anesthetic agents generally used in dentistry all have their merits and indications. The choice of the anesthetic to be employed should be determined by the exigencies of the case and the selection should be left to the operator in charge. Postoperative care is essential for proper prognosis, and this phase is sometimes neglected. Dr. Wahl reminds us of this, and I can only reemphasize the salient points. Patients should be advised to rest the parts operated on as far as is practicable, while rest of the patient is likewise conducive to hastening recovery. A light diet, with more than the normal amount of fluid intake, is advised. Regardless of the simplicity or gravity of the operation, the patient should be seen subsequently and as often as may be necessary, this depending on the nature of the case. Every case should receive the same attention in postoperative care as in the performance of the original operation itself, care which should not be relaxed until the operator is satisfied and the patient discharged.

*M. Hillel Feldman, New York City:* I wish to say a few words with regard to the mallet and chisel. As often as we hear the question of impacted teeth presented for discussion, there seems to be exclusive reliance on the technic of the mallet and chisel. I maintain the position that the use of motor-driven force carrying a drill or a bur, or any suitable engine instrument for the sectioning of bone, is just as surgical a means. There is no professional necessity to impress on the patient the seriousness of the operation which would require chisel-mallet technic. General practitioners, when using the dental engine for the removal of impacted teeth, should recognize that they are using a surgical instrument. The dental engine is an instrument which is used in general practice, and therefore the general practitioner is thoroughly familiar with its adaptability. When we use the engine for the removal of bone which overlies embedded teeth, removing the tooth either in its entirety or in sections, thus simplifying the operation and minimizing trauma, we are using a technic which is just as noble in its heritage as the use of the chisel and mallet. I find that the use of the engine in the technic which I have outlined on many occasions obviates the necessity for so-called postmolar relief. In general surgery, the engine is used for the relief of pressure on the brain, and for the open reduction of long bone fractures. In the latter operations, I have seen silver screws inserted into bone with a force far greater than is necessary in using a drill on the jaw bone; and the latter would be called by some a nonsurgical procedure. The engine is used for drilling holes in the mandible where there has been a loss of bone substance. Silver wire is introduced into these openings to ligate the approximating sections. This is also a surgical operation. The dental engine must be in your hands as it is in mine a successful adjunct to sound practice. I have discarded the use of the chisel and mallet in all of the operations

shown here today by Dr. Wahl with just as good postoperative results.

*Frederick S. Stillwell, Cincinnati, Ohio:* I wish to ask, whether, in the case of impaction of a third molar still in its formative stage and in its crypt, enough pressure can be exerted to cause a moving of the teeth anterior to the third molar. How early can a third molar be removed? Should removal be attempted before the roots of the second molar are fully developed? I am speaking of it from an orthodontic point of view. Very often, the third molars have a decided tendency to an impaction. Their removal only interferes with the progress of the work. How early can these third molars be removed?

*Dr. Wahl (closing):* I am sorry that many more did not say something about their experiences. The experience of various men is worth more to our organization than the statement of one telling how a thing should be done. In answer to Dr. Feldman I said before that the technic used was as varied as the colors of the rainbow. If Dr. Feldman can use a drill better than I can use a chisel, he should use the drill. I used the drill in my early practice and I found many things that I did not like about it. The chisel is, in my hand, far superior to the drill. In answer to Dr. Bear: I did not say that simply taking out an impacted mandibular third molar was a panacea for any ailments, but I will say this: there are a great many times where everything else fails and the removal of the impacted mandibular molar brings about the desired results. A priest suffered with severe abdominal pain for six years. Nobody would be so foolish as to tell a person so affected that removal of an impacted tooth would cure him. But we know that impacted teeth are abnormal and abnormal conditions, in my estimation, should be eliminated. We removed the impacted mandibular third molar and he obtained relief. He is happy not because a third molar was removed but because he obtained the results he desired. In answer to Dr. Stillwell, I would say that the orthodonists of New Orleans have been struggling with that question for quite a while. I would not at any time advise removal of an impacted tooth, say a third molar in its formation, before the roots of the second molar had been fully developed. That would be poor surgery, and the patient would be entirely too young at that. But the earlier we can get these teeth out, the less after-trouble we are going to have. The osseous structure is much softer and much easier to handle. The patient has more resistance. There are no end results such as insomnia, melancholia and other nervous conditions that have taken place, as yet, because the patient is so young. If for no other reason, we should take these teeth out as early as possible. As to diet, I have never investigated that phase. I said in the beginning that I was touching the high spots. I think there is still much to be learned about impacted mandibular third molars. I might know how to take them out, but whether diet has anything to do with these teeth becoming impacted or not, I do not know.

# MAKING THE MOST OF THE ROENTGENOGRAM*

By FREDERICK F. MOLT, D.D.S., Chicago, Ill.

THE dentist possessed of a conscience accepts the roentgenogram as a requisite preliminary to or accompaniment of his operative procedure. The slipshod operator, whether because he is willing to take chances, is timid as to the roentgenographic disclosures, assumes not to believe what is plainly shown or is interested in revenue only is usually not interested in its use. As an indication of honest intention, therefore, we should examine each case by the roentgen rays.

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

It must be recognized that the roentgenogram does not supplant clinical examination; it is merely a valuable adjunct. Roentgenographic evidence either may be verified or it may be contradicted by clinical findings. Usually, one will amplify the other, and should be so utilized. It cannot be too frequently stressed that the reading of the roentgenogram does not constitute a diagnosis, and that the factors of clinical examination, symptomatology and history must all be alined therewith in order to complete the clinical picture.

Unquestionably, the greatest good that the roentgenogram may accomplish is in relation to prophylaxis, the prevention of diseased conditions. If we have the opportunity to discover caries and gingival destruction in their incipiency, we shall have gone a long way toward preventing the loss of teeth. It is assumed, of course, that, having the roentgenogram, the dentist will discover and adequately care for the conditions shown.

A periodic checkup of the entire mouth is to be advocated for each patient. This may be done with Raper's bite-wing films, which show the crowns, gingivae and interdental spaces, or with complete roentgenographic exposure, including extraoral lateral jaw roentgenograms. Each has definite advantages. The bite-wing film eliminates all distortion by lengthening or foreshortening (if properly positioned) and may give for the upper posterior teeth a more exact disclosure of interproximal conditions. On the other hand, there is the knowledge of apical and periapical conditions, malformation and malposition of teeth that only the complete panorama of the mouth may show. A combination of complete and bite-wing exposures is well worth while.

Roentgenograms may be good, poor or absolutely worthless, and, unfortunately, all too many of those produced by the general practitioner fall into the last-mentioned class. He is not by any means the only offender, as many hospital technicians and "cut-rate" operators, in what Simpson designates as "radiographic shooting galleries (so much a shot, hit or miss)" produce roentgenograms that leave much to the imagination.

An "interpretable" roentgenogram calls for perfection in many factors. Primarily, it must be complete, consisting of a sufficient number of overlapping exposures to permit of no doubt as to any area. Distortion should be avoided, if possible, in all cases, and this means the avoidance of overlapping, widening, foreshortening or lengthening of the image beyond a very moderate degree. Distortion may be due to the faulty placing or the bending of the film or to inaccurate positioning of the tube or patient; or a combination of these faults.

Overexposure or underexposure may produce an almost equally undesirable result. The overexposed film obscures valuable details by making the film too black to be penetrated by the viewing light. The underexposed film has so little density that the details are equally hard to determine. Any effort to force development of an underexposed film is useless, and to underdevelop an overexposed film means a lack of detail. Overexposure may be due to too great penetration or too long exposure time; underexposure, the reverse. Repetition of one essential fact regarding exposure technic is therefore well worth while; the determination of the proper exposure time for the individual machine lies entirely in the developing room, for a properly exposed film of an average subject will develop, with fresh developing solution at 65 F., in five minutes. All the requisite chemical change will have taken place, and addi-

tional developing time will only serve to fog or discolor the film.

Many films that have been properly exposed are ruined in developing. With the developer too warm, fogging is inevitable and a "muddy" film is the result; too cold a developer does not accomplish the necessary chemical reaction, and the result is a "thin" film, without detail.

Light leaks in the dark-room, too bright dark-room illumination, as well as insufficient protection for the films from secondary roentgen rays previous to exposure, all may result in fogging of the film.

The fixing bath should be kept fresh and renewed at frequent intervals. Films should remain in the hyposulphite bath twice as long as is necessary to overcome their milky white appearance.

It is assumed that the roentgenogram is to constitute a permanent record of the case. Much of its value lies in our being able to refer it at any future date. It is essential, therefore, that the last step, washing, be just as carefully done as the rest. The films should be washed for twenty minutes in clean running water and then dried, free from dust. An unwashed or insufficiently washed film when dried has a greasy appearance and will in a short time show brown hyposulphite stains that will, in time, obscure much of the image and render the roentgenogram valueless.

The desirable roentgenogram shows brilliancy of detail and contrast, with black black and white white. Such an ideal result cannot, of course, be obtained in every case, but if the predetermined exposure technic is rigidly adhered to, with timing recognizing variations adapted to individual areas, and if uniform development and thorough washing are followed out, the larger proportion of films produced will be most satisfactory.

The reading of the product assumes an important aspect as well. One should be chary about overinterpreting the roentgenogram, and yet should be alive to any significant deviation from the normal. Anatomic radiolucence and radiopacity will, of course, be recognized, for the shadows of the anterior and posterior palatine foramina, nasal and canine fossae, maxillary sinuses and malar eminences in the maxilla, and of the incisive fossa, mental foramen, inferior dental canal and mylohyoid groove in the mandible, have been so frequently commented on as not to need further mention. The tooth outline is carefully observed for any break in its contour indicating beginning caries. Restorations are carefully noted for any leakage, overhang or lack of contact point.

Next, the gingiva is carefully observed for any recession or for that space between the black line of the peridental membrane and the white line of the lamina dura that indicates traumatic occlusion and is the precursor of definite pyorrheic destruction.

As we go on to the apex of the tooth, there are various conditions to be looked for: a thickening of the periodontium, or a more extensive periapical lesion which may be either granuloma, peri-alveolar abscess or cyst. Incidental to this examination, root-end conditions are noted, including hypoplastic or hyperplastic changes or malformations. These abnormalities have no particular bearing on the infection aspect of the tooth, the pulpless tooth that has been absorbed or that showing hypercementosis being no more menacing than the one roentgenographically negative; but they have a definite relation to the problem that will arise if extraction is indicated.

Teeth that have been long pulpless are noted, in a large proportion of cases, to

show no pericemental line. The condition found on extraction is identically that: the pericementum has been entirely obliterated, indentations of absorption into the cementum are found, and built into these are bony accretions. Such a situation, combined with the known friability of pulpless teeth, explains the difficulty encountered in so many extractions of "dead" teeth.

The cause of endless controversy and fruitless discussions, the pulpless tooth, is always in the limelight. It should by this time be recognized that the roentgenographic appearance of such a tooth has little bearing on its relation to focal infection manifestations. Two statements may be made in this connection, although many will undoubtedly question them; that the "roentgenographically negative" pulpless tooth, unless recently devitalized under aseptic canal procedure, is as open to suspicion as is that one showing a periapical lesion; and that a fluctuating degree of periapical destruction or its entire disappearance has little significance in determining the potentiality of the individual tooth in relation to systemic malfunction. This is no doubt a radical attitude to assume, yet based, as it is, upon the observation of a multitude of cases as well as upon the findings of other observers, it becomes perfectly logical. The conclusions to be drawn are that unnecessary devitalization of teeth is unjustifiable and that the retention of pulpless teeth, whether the canals are well or poorly filled or whether the tooth has been aseptically devitalized or reclaimed from putrescence, is to be determined, in greatest measure, by the individual systemic condition. This fact is too often ignored or lost sight of.

The proximity of a filling to the pulp of a tooth may in most cases be noted. The behavior of the pulp in one case may not be that in another apparently identical, as, in the one, there may be a protective formation of secondary dentin guarding against thermal shock; while, in the other, no such protection will be provided, and the pulp will eventually succumb. No prognosis may therefore be offered—simply a notation as to the existing condition.

Just why pulp accretions are formed has never been satisfactorily explained, although it is quite likely that dietary deficiency or imbalance may be the cause. Such a condition, frequently so extreme as to involve practically every tooth, may hold out the prospect of pulp disintegration and putrefactive reaction in one or many of these teeth which are otherwise perfectly sound. The pulps or pulp remnants are so lacking in vitality that they are either sluggish or negative in their response to the vitality test, and one may frequently expose such a pulp with no apparent pain.

A situation may be disclosed by the roentgenogram in which, as alternatives, either devitalization or extraction is presented. Knowledge of the eventual possibilities of any pulpless tooth would contraindicate gratuitous devitalization, and yet it may be much more desirable, the patient understanding and coinciding in the choice, to retain such a tooth aseptically devitalized and with the canals filled with the greatest possible care. Root-canal treatment and filling bade fair at one time to become a specialty in itself. No doubt, if it is worth doing, it is worth doing well. Doing this work well calls for a preliminary knowledge of approximately exact root length and roentgenographic observation from time to time during the progress of the enlarging of the canal, measuring wires being employed to determine the proximity to the root end. A rather exacting tech-

nic is required for this, not only to avoid distortion but also to permit of duplication, as exactly as is possible, of the previous view.

Overfilling of canals and filling to the apical orifices only each have, as methods, their devotees. Underfilling has always been in disfavor; yet roentgenographically no more underfilled canals than those of the other groups will be found to show periapical involvement. Perhaps many of these underfilled canals still harbor fragments of vital pulp tissue and are thus even more safe than those completely filled. We still may profitably indulge in laboratory observation of these phenomena. It may be that we will eventually be able to make the odontoblasts do "tricks" for us and provide a satisfactory method of canal filling *au naturel.*

The alveolar structure surrounding the teeth is of course observed, and that in edentulous areas is examined for residual infection of either the circumscribed cystic or irregularly outlined granular type. If an interval of more than six months has elapsed since the extraction of a tooth, such an area shown in an edentulous space may be regarded with suspicion.

The determination of the degree of calcification that is shown in the alveolar structure in the individual case is important. In this connection, a fixed roentgenographic penetration is of value, in contrast to varying the penetration from case to case, as comparisons may thus be made. Thus, the highly calcified bony structure will unquestionably provide a more stable base for either partial or complete restoration than that showing excessive radiolucence. This applies as well to regions in which so-called disuse atrophy has taken place, in relation to both the extraction problem and the lack of substantial base for restoration.

Altogether the ability to produce an interpretable roentgenogram and to read it when produced, combined with a willingness to acknowledge conditions requiring correction and to remedy them, provides many possibilities in modern dental practice. Making the most of this adjunct means utilizing the knowledge that it imparts in preventing the progress of caries and pyorrhea, in determining the need of restorative procedures and in assuring their successful completion.

In making the so-called dental diagnosis as a component of general diagnostic observation, the roentgenogram is an essential factor. Properly made, it may be misinterpreted, but it does not itself falsify; improperly made, it may be worse than useless, suggesting conditions that do not exist. It is worth while, therefore, to demand or produce complete well-made roentgenograms, study them carefully and predicate our procedures upon their disclosures.

25 East Washington Street.

DISCUSSION

*L. R. Main, St. Louis, Mo.:* If we are to make the most of the roentgenogram, the first step necessary is to be able to produce a film of diagnostic value. This would include everything Dr. Molt has said about careful technic in exposure and also the process of dark-room procedure. The chief difficulty in radiodontia is our inability to make a good roentgenogram. I would take it for granted that we have a good film of diagnostic quality to begin with, as this is perhaps the most important basis for all our operative procedure, whether mechanical, medical or surgical. Except in cases of gross pathologic change, we can determine little from an improperly made roentgenogram, and even in such cases, a poorly made film may be very misleading. A point which Dr. Molt suggested and which I wish to stress is the necessity for ascertaining something of the

patient's health, when interpretations of roentgenograms are considered, with the view of making recommendations for radical or conservative treatment. There are instances in which it is advisable to extract all pulpless teeth even though they are roentgenographically negative. This devolves an additional responsibility on the dentist as every radiolucent area on the apex of a tooth is not positive proof of the presence of infective organisms in the area. Neither is it true that all pulpless teeth which are roentgenographically negative are free from the results of infection. In some of our cases of doubtful findings, the general health and history of the case will indicate the advisability of radical or conservative treatment. I agree with Dr. Molt in that underfilling of pulp canals is looked on with disfavor, but I most emphatically do not believe that underfilled or poorly filled canals show up to such good advantage in roentgenograms as when canal operations have been successful in filling to or slightly beyond the apical foramen. Generally speaking, an operator who endeavors to fill a canal to the apical region is somewhat careful about asepsis. Such work is uniformly more nearly free of periapical destruction on roentgenographic evidence. Dr. Molt refers to our possible ability to make the osteoblasts do "tricks" for us and to provide in this method a satisfactory method of canal filling. We are concerned about the activity of the osteoblast whenever we desire a regeneration of bone in the periapical region, when there is destruction. But if root canals are to be filled through some natural process, we will have to depend on the activity of the odontoblast and cementoblasts for this desirable condition. Knowledge is power everywhere. We always "ask the man who knows.' So if, under roentgen-ray observation, certain conditions are revealed which are abnormal, it behooves us to make the necessary correction. Knowledge is power *only* when that knowledge is acted on to produce results. Information which is secured through roentgenographic efforts may not be appreciated by a certain class of operators who prefer to take chances, as the doctor suggested, rather than resort to securing roentgen-ray information. But there is another class which deserves even less consideration and that is represented by the man who resorts to the roentgenogram to the extent of collecting a fee and then does his reconstruction almost irrespective of the roentgen-ray findings. The type of roentgenographic work which is sometimes palmed off on the public under the name of radiodontia makes it impossible, in many instances, for even the dentist to "make the most of the roentgenogram" as the chief source of information for operative procedure. The "Making the Most of the Roentgenogram" is important in the progress of dentistry because the roentgen rays are becoming more widely and favorably used year after year.

*DeLos L. Hill, Atlanta, Ga.:* One of the most important things brought out is the necessity for proper distance of the tube from the object which is to be roentgenographed. I agree with Dr. Molt in most of the technic to which he has called attention, for unless there is a definite technic in making roentgenograms, we cannot depend on the results obtained for a roentgenographic examination. I hardly know whether the classifica- of "good," "poor" and "worthless" is correct. I feel that roentgenograms are "good" or they are "bad"; and if they are bad, they are worse than worthless, because you are liable to be misled. If the roentgenogram is not satisfactory, it is better to discard it rather than take the chance of being misled in the reading of something into it which does not exist, or overlooking something which should be shown. We as dentists are making one of the greatest mistakes in our career in not making roentgenograms of every case when the patient first comes in. It gives us information which can be followed up as we may see fit by further roentgenographic examination at a later time. Roentgenographic examination (and I wish to stress this point) does not constitute a diagnosis. It is simply an aid to a diagnosis and must be used in conjunction with a clinical diagnosis in order to reach conclusions on which we can depend. If we are going to make the most of the roentgenogram, the point that Dr. Molt brings out in the first part of his paper on preventing trouble, or locating the trouble in its incipiency, is of the greatest value. Wrecked mouths would never exist if they had received proper consideration years earlier and defects had been overcome before they were discernible by a clinical examination alone. Let me touch on the matter of distance and technic, because there the greatest number of mistakes are made, resulting in so many worthless films. If the

technic is carried out so that the only variations will be from the standpoint of exposure, we will get results on which we can depend. I would say the target distance should be from 18 to 24 inches; some say 36 inches. If we use a target distance of from 18 to 36 inches, we eliminate certain rays which have a tendency to reduce the efficiency of the film, and the results are more satisfactory. I wish to stress washing. There is not anything so unsatisfactory to a dentist as to refer to a roentgenogram which has been made six or twelve months previously, only to find that it has turned yellow. The washing is just as much a point of technic as any other part of the work. Many roentgenograms which might have produced results have been ruined in their development. It is well to remember to develop the films the length of time called for and to wash thoroughly. An automobile runs best under certain conditions. If we take a film that is supposed to be developed a certain length of time and develop it for a longer period of time, the best results will not be obtained. Every pulpless tooth is suspicious, but we must not be too radical. We must not come to the conclusion simply because a tooth is pulpless that that tooth (while it may be suspicious) must be removed. In the opinion of many operative men, thousands and thousands of teeth have been sacrificed when there was no direct evidence that they were the cause of systemic trouble. As long as nature is as good to humanity as it is, there should be many teeth left for treatment, and the conservative element of operative men, at the present time, believe the best service is rendered the patient when we treat these cases, in many instances, and give the owner the benefit of their use as long as they are not a menace to health. This, of course, requires frequent observation. We should make the most of the roentgenogram in orthodontic work. We should realize its usefulness in the location of missing teeth and their correct position, if they exist. This can be done only by the use of films placed horizontally in the mouth between the upper and lower teeth and interpreted in conjunction with normal intra-oral films. An interesting case came to me from an orthodontist, who was trying to ascertain the exact position of an upper left central incisor which was placed between the lateral incisor and the cuspid. We wish to learn what part of that missing central incisor was closest to the cuspid.

*Dr. Molt (closing):* Dr. Hill questioned the necessity of anticipating trouble with the roentgenogram. I said that it should be used both as preliminary to and a complement of operative work. It is folly, if we are accepting a new patient, not to prepare for his work with a roentgenographic examination, because, by omitting this, we are naturally assuming responsibility for everything that has been done previous to our own operative work. Regarding technic, Dr. Hill spoke of the advantage of the 18 or 24-inch distance. I might say that I use a 36-inch target distance, which throws out most of the secondary radiation, improving the roentgenogram thereby. I purposely brought up the question of pulpless teeth, because we are too much inclined to overlook this point. We must concede that, under certain circumstances, every pulpless tooth is open to question. The roentgenogram is not our index; the patient is the index, the patient and not the mouth. Frequently, the decision must be made by the physician since to assume to make such a decision ourselves means entering into a field other than our own. This matter of determining the connection between the pulpless teeth and the patient's physical condition is a matter calling for good judgment and common sense. We must not overlook our patient and let him die just because we want to retain a few teeth. I might, in this connection, quote one of our physicians in Chicago. A patient with a serious case of iritis had, as well, a pulpless tooth, which might be causing the trouble. The logical thing to do was to remove the tooth, but the patient's dentist told her that he could save it and wanted to do so for esthetic purposes. The lady told her physician about her dentist's attitude and he said. "You can always get a new tooth, but you can never get a new eye!" So I repeat, a rational sense of proportion will dictate when we should be conservative and when radical.

# FULL DENTURE CONSTRUCTION*

By GEORGE P. PHILLIPS, A.B., D.M.D., Boston, Mass.

DR. HALL'S article on full denture construction covers forty-two pages in THE JOURNAL, and as many phases of the subject. Considerable time is given to a description of the three-dimensional articulator, a very ingenious instrument, based on sound principles, but too highly specialized and limited, as far as ease of manipulation is concerned, to be of any great value to the average practitioner, and also impractical because, after a case is reground with it, no freedom is provided in masticatory action in the intermediate positions other than the three positional relations; which is very essential to tissue health.

On page 1164, Dr. Hall states: "There is no articulator, nor will there ever be an articulator that will accurately reproduce the movements of the mandible." We all agree that the movements of the mandible cannot be reproduced with absolute fidelity, but we can reproduce them accurately enough for all practical purposes, and I do not see that we gain anything if we attempt to do any more than this. He also states, on page 1165, that "nothing more is required, and nothing less will answer the purpose," and also that his articulator "will stand for all time to come." Now, if regrinding dentures to relieve cusp interferences ruins them, and if balanced occlusion in full denture construction is a myth, as Dr. Hall concludes, why did he design the articulator which he describes? If I am not mistaken, the three-dimensional articulator was designed primarily to bring about balance and assist in regrinding dentures.

It is an admission of defeat in our previous efforts, when we begin to derive comfort in retrospection, as Dr. Hall does on page 1177, when he speaks of the old-time dentures with shallow cusps, or practically no cusps at all, and with what cusps there were occluding, end to end, which became a part of and remained a part of the patient for life, growing better as time went on. Also referring to these good old-time dentures, Dr. Hall makes this statement: "Never being in correct relation, these dentures could only get better, not worse." How could these dentures *improve* if they were not in correct relation to one another? Is it the dentures or our good old friend Nature that has come to the rescue?

Granting that a certain number of these old dentures proved very satisfactory, we will find that the dentists who made them invariably followed the same technic right through for every case, with the inevitable certain percentage of useful dentures, and also of failures. We do not hear anything of their failures. At the bottom of page 1170, Dr. Hall states:

*A discussion of Rupert E. Hall's paper published in the July issue.

*Read before the Section on Full Denture Prosthesis at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

"Until recently, I doubt that I have made two sets of dentures using the same identical technic throughout." This statement accounts for a good deal of the uncertainty and the chaotic condition in which denture construction now is. Some of us do not try a thing long enough, and swing back and forth from one thing to another. Now, if these dentures which were made with the cusps of the teeth ground flat should be our ideal, why try to improve on them by redesigning others? We can still buy them for a dollar a set.

Dr. Hall follows a false analogy when he compares the pulp-grinding machine to the inverted cusp teeth. It is true that a pulp-grinding machine such as the one Dr. Hall describes will grind better and finer than a machine that has teeth and planes, but a machine with teeth and planes requires less power to run than a machine with cups. Manufacturers have no difficulty in increasing the power for the running of any machine; but, in the mouth, we have to minimize chewing effort as much as possible.

It is very evident, therefore, that properly articulated cusped teeth will grind better and easier than teeth without cusps. I think the addition of cups to cuspless teeth will have a tendency to increase the effort on the part of the patient. There is no comparison between the human jaw and a machine of this sort. The food is not thrown in between the teeth by centrifugal force. We do not have to go to machines to get our inspiration. We have the natural teeth from which to get our guidance.

Dr. Gysi was aware of this when he designed his posterior teeth, and these so far have not been improved on. He has retained all the features of the forms of the natural teeth which could be utilized, and incorporated others to meet the difficulties of stabilization. Later, he designed the crossbite teeth for special cases in which the laws of leverage were working against stabilization.

The presence of cusps or the lack of cusps on the teeth is not the deciding feature in denture construction. No one disputes the fact that steep cusp teeth, or any others used, arranged *injudiciously* on dentures of poor stability, flat ridges and a flat palate, will do irreparable harm. It is for this reason that we vary the cusp inclination by regrinding to meet these conditions. For example, in a given case, if we have healthy tissues, good ridges and a good palate, and we can obtain considerable lateral stabilization, we use teeth of as steep cusp inclination as the case may tolerate. These chew better. If the tissue conditions should indicate the use of lower cusps or even no cusps at all, we should take account of these indications; but to condemn every patient to wear flat cusp teeth because they can be easily articulated and thrown together does not constitute a procedure in accordance with the high standards of the dental profession. Inverted cusp teeth will not prevent or even minimize tissue destruction. If the cusps of the teeth are responsible for tissue resorption, what causes the complete resorption we so often find in many mouths that have never worn dentures and in which the remaining teeth show not the slightest indication of peridental disease?

His method of employing the central bearing idea in regrinding teeth in the mouth does not seem to me to be sound. With a central point bearing against a flat surface in the mouth, this cannot be accomplished, unless, instead of a flat surface, one grooved to harmonize with the mandibular movements is employed. If not, the central bearing becomes a source of interference. The central bear-

ing idea should be utilized only in taking registrations, and for nothing else. That is the only purpose for which it has been advocated by me.

Dr. Hall's findings about the Gysi gothic arch do not harmonize with mine. On page 1184, Dr. Hall states: "This center (referring to the functional centric relation) has been found to be different in some cases from that indicated by the gothic arch tracing after Gysi, and assumed to be functional." As far as I can make out from this paper, Dr. Hall bases his conclusions on three cases in which he failed. I have failed in more cases than one, but in every case, by checking up my various steps, I found that I had slipped in my technic. In some cases, I had forced the patient to trace a semblance of a gothic arch; in others, I had improperly fitting trial plates, and, in others, I had failed to relieve heel interference sufficiently to assure stabilization of the trial plates. All these failures I have checked, and I have attributed them to poor technic.

Even if my findings coincided with Dr. Hall's regarding the reliability of the gothic arch, I would be afraid to go on record as questioning it, in the face of the time and thought which Dr. Gysi has put into this subject for almost twenty years. I do not wish to be misunderstood as blindly considering Dr. Gysi infallible, but his experiments and the number of cases that he has handled from a purely scientific standpoint outnumber any of ours by a very large margin.

Dr. Tench will bear me out in this. To test the reliability of the gothic arch, Dr. Tench made a number of cases with the gothic arch and a similar number with the opening and closing method. As a result, he had to remake a large percentage of the cases in which he took the relations with the opening and closing method, but had to remake none of the cases in which the gothic arch was used. If the opening and closing method can be accepted as sufficiently accurate to be used as a check on the gothic arch method, why not discard the gothic arch entirely? The gothic arch is a strained relation and it has to be so, because mastication itself is action under strain.

Regarding balanced occlusion, Dr. Hall states, on page 1191: "Balanced occlusion is another phase of denture work that I have never been able to accept and enthuse over. It has never been proved to my satisfaction that balanced occlusion makes for any greater efficiency or permanency in dentures than the good plain occluded teeth arranged in the ordinary way." What is the ordinary way? Also, "The mere insertion of so small a thing as a pin between the teeth on the working side separates the teeth completely on both the working and the balancing sides, destroying balance, making it valueless as a supporting or stabilizing means against dislodging dentures."

One would be very ignorant to dispute the fact that inserting a hard metal pin between the teeth on one side of a denture would interfere with the contact on the other side; but let us see what happens in the mouth. Our greatest difficulty in stabilizing dentures is with mouths with thin, nonyielding mucosa. Full denture wearers, if properly instructed, take smaller mouthfuls, and cut their food into much smaller pieces than they have been accustomed to before they lost their teeth. When such pieces of food are placed between the teeth, there is the inevitable tendency for the dentures to become unseated. This is more pronounced in the mouth of patients with thin mucosa than in patients with firm but resilient tissues.

In well-balanced dentures, as the patient closes on the pieces of food, the tissues under the dentures are compressed on the working side and relieved on the balancing side, but are still in contact with the tissues. The condyle on the working side becomes slightly unseated, but the condyle on the balancing side comes into closer contact with the glenoid fossa through the mobility of the meniscus, so that when the particles of food on the working side separate the dentures, the resiliency and adaptiveness of the condyles in their fossae, and the compressibility of the tissues compensate for, and partly or wholly offset, the tendency for the dentures to become unseated. This accommodation of the tissues to stresses is my conception of what happens in well balanced cases, and so far, it is substantiated by the results. If any one doubts this, let him occlude the teeth in the *ordinary way,* and see what will then happen.

No denture, with however good an adaptation, will survive this condition long, unless the patient happens to be one who easily becomes adapted to changes. Such a patient will immediately change his method and habits of chewing, and instead of grinding, he will chop his food after a fashion, avoiding any movements of the jaw that will meet with interference.

If balanced occlusion has been misunderstood, it is not the fault of balanced occlusion, but the fault of those who expect any one operation to cure all the ills of denture construction.

Dr. Hall's reference to a pin inserted between the teeth is not a fair example. Leaving a single cusp high by even a few thousandths inch only would do the same thing; but yielding or crushable food many times the thickness of a pin will not do it.

Figure 47, page 1193, showing a bolus of food between the teeth on one side, does not show what happens in the mouth.

Cuspless teeth encourage bad habits, encourage prognathism,totally destroying the tactile sense of the underlying tissues, which is so essential to the enjoyment of chewing, and would cause more resorption than properly balanced cusped teeth; because to grind with equal efficiency, cuspless teeth require more force.

The millennium in full dentures is not here, and will not be brought about with inverted cusp teeth, nor with any other teeth.

483 Beacon Street.

# RESEARCH IN SUBGINGIVAL THERAPY*

By A. B. VASTINE, D.D.S., Danville, Pa.

THE term "therapy" is used advisedly to portray more vividly the actual existence of a vicious cycle that is to be studied and cared for rather than a mere local condition that requires treatment.

Subgingival therapy may be defined as a system by which both the positive and the negative factors in gingival or alveolar trench[1] disease is properly evaluated and treated. A technic whereby a specific or near-specific may be used for each of the causative organisms entering into the local infection is especially stressed.

It has been a difficult matter to interest effectively those who are responsible for the care of the local field in the broader aspect of the problem involved in subgingival disease of the tooth joints; meaning by tooth joint that structural mechanism by which the dental organ maintains its functional connection within the supporting structure. A disposition to regard each tooth as an entity has led to one of the many misconceptions of the problem of gingivitis. The term "gingival or alveolar trench," both maxillary and mandibular, is descriptive and helps to convey the idea of complete survey, which in principle is accepted but in practice is seldom accomplished.

By regarding the subgingival system of treatment as a therapy, a broader field is implied, which focuses the attention on manifestations other than local that are associated with reactions in the gingival trench.

A crying need of the day is for a system of diagnosis and treatment that will be universally applicable and at the same time definitely connect the infections of the gingival trench with other involvements. The prevalence of subgingival disease is such that an effective method of control should be at the disposal of every member of the health service.

The local aspect of subgingival disturbance must be diagnosed differentially and its association with other disease conditions must be noted in order to connect cause with effect.

The local findings may be represented diagrammatically by the four plus system for evaluating each factor entering into the diagnostic picture. The reactions to be noted are clinical roentgenographic or osseous and microscopic as represented by smear and differential bacterial findings, as well as the local $p_H$ value. This will give a picture from which some remarkable deductions may be made. A differential diagnosis between reactions in the gingival trench and other parts is well exemplified by the relation existing between the former and the tonsils. If the gingivitis is the sole factor, the re-

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

1. The term "alveolar trench" was used in discussion of a paper before the Maryland State Dental Society, in May, 1929.

sponse to subgingival therapy is prompt and may be maintained. If it is complicated by focal tonsillar infection, there will be a response to treatment, but it will be difficult to hold the improvement. When the tonsillar condition is eliminated, subgingival treatment is effective, and the result is readily held. This is cited because tonsillar, nasopharyngeal and accessory sinus infections are most frequent complicating factors in gingivitis. The same is true of cysts of the mandible, cysts of the maxilla and gastro-intestinal involvements such as chronic atrophic gastritis with malnutrition, gallbladder disease, and many other maladies, especially thyroid involvement and those which are the result of focal infection.

Another way in which a differential diagnosis may be arrived at is to institute subgingival therapy for iritis or certain types of dermatitis arising from focal infection. If response is favorable, we know that oral focal infection is the causative condition, the elimination of which promises definite relief for the iritis or dermatitis.

This focal infection may not necessarily be due to a gingival condition, as periapical or cystic infection may also be relieved by the subgingival technic. By a similar treatment of the tonsils, a neuritis of the arm may be demonstrated as coming from the tonsils and not from a dental source. It must be kept in mind that in a habitat for bacteria, such as may be established in the crypt of the tonsil or in the tubuli of the teeth, this relief has only diagnostic significance and palliative value, and is in no sense to be regarded as a cure of established foci of infection where the source of the invading organism is not eliminated or restored to a perfectly normal condition.

Where a source of focally potential organisms cannot be completely obliterated, a focus of infection is practically certain to occur. I feel that the importance of a differentiation between a bacterial habitat and a focus of infection is not appreciated. Some infected areas can often be completely eliminated without appreciable functional damage and thus the reestablishment of an active focus of infection be prevented. The tonsils and the appendix are good examples. Other infected organs or tissues have to be eliminated in spite of the functional damage incurred, while other vulnerable areas, such as the nasopharynx and the gingival trench intermittently require attention. The gingival trench is peculiarly susceptible to invasion by organisms with a marked potential for becoming foci of infection. As this habitat cannot be cleared without functional damage, intermittent treatment is necessary in a majority of these affections of the gingival trench and tooth joints if they are to be effectively handled.

Thorough subgingival therapy with follow-up has the possibility of largely eliminating bacterial habitat and preventing a focal syndrome from originating in the gingival trench. Periapical or tonsillar infections seldom or never can be eliminated as potential foci of infections except by removal or complete elimination of the bacterial habitat.

Subgingival treatment has a wide range of use, but it is distinctly valuable as the most effective method that we have yet found for preoperative preparation, a most effective method for the treating of acute and chronic gingivitis; for infections around erupting teeth, and the retromolar areas; for controlling certain cases of osteomyelitis; for relieving acute periapical infection; for treating in children or in adults glandular involvements having their origin in gingival or follicular infections; for the

treatment of, or preparation for operating in, a maxillary sinusitis of dental origin, whether having a periapical, follicular or gingival source; for reducing some larger intra-oral cysts before operating, thus simplifying operative technic; for eliminating certain forms of facial dermatitis; and so on through the realm of oral disease and its manifestations, we have a direct or an indirect use for subgingival therapy.

Every effort should be made to eliminate, as far as possible, all bacterial habitats. These harbors for the incubation of organisms can be eliminated as far as imperfect dentistry is concerned; but the conditions resultant on malposition of dental organs whether acquired or inherent is not so readily controlled. My own conviction is that traumatic occlusion and drift in the dental organs has been much overestimated as a factor in gingivitis. In this connection, the pulpless tooth must be regarded as a bacterial habitat unless it can be definitely proved otherwise.

The main approach to treatment lies in elimination of subgingival infection before eradication, as far as possible, of all known foci of infection. Followup is then to be determined by the needs of each individual case, as regards persistency of infection, dietetic deficiency and toxins. This usually requires for the infection a specific in the form of subgingival medication for each type of organism entering into the subgingival invasion. The most common organisms encountered are spirilla, amebae and the cocci, although there are others to be reckoned with. The correction of the dietetic deficiencies and any gastro-intestinal infection or functional disorder is important, constituting the other main avenue through which treatment is to be approached. What the actual medication should be is not fully undetermined. After the trial of nearly every drug or combination of drugs that has been called to my attention, I have found that for most of the cocci, where deep penetration is required, such as in the temporary control of subgingival and periapical infection, whether the infection is acute or chronic, mercurochrome, gentian violet and acriviolet are most effective. For the superficial infection, the various arsenical, chlorin, iodin, zinc, phenol, silver and mercury preparations have value, as well as the use of oxidizing and alkaline agents.

It is important that differential diagnosis be made between superficial and deep infection, especially where the cocci or bacilli are concerned, as different treatment is required according to the conditions under which the organisms grow, that is, whether the mechanism of a cyst has actually been established or not. The variation in oxygen tension under which bacteria live is something with which we are all familiar, also the variation in the $p_H$ value of the environment.

There are many factors, known and unknown, determining the type of organisms and the severity of the infection. The schedule of treatment for the recurrent infection is governed largely by virility of the organism, environment of the bacterial habitat, periodicity of incubation of the infecting organisms and factors of immunity. Medication is necessarily much in question but will become more definitely specific as the various factors entering into treatment for a given infection of the gingival trench are known. It hinges on a definite specific for each organism entering into the infection and an effective technic for the intermittent application of the specific.

For Vincent's organisms, we are finding arsphenamin most valuable. This may be used in various combinations, for the subacute infection, 5 per cent in glycerin; for acute infections, the pure arsphenamin powder after or in combination with an alkalinizing oxidizing agent such as sodium perborate. Vincent's organism is classed as an acid anaerobe. Arsphenamin dissolves well in an alkaline medium; hence, the need for alkalinization with or before using the pure arsphenamin powder. For the ameba, we have found nothing to take the place of emetin hydrochlorid in one-half grain doses intramuscularly. It must be remembered that all those agents have certain effects, which we know definitely, as well as certain hypothetical or supposed effects. For instance, we know emetin is definitely effective for the ameba, both intestinal and gingival. Through its amebacidal powers, it may introduce a foreign protein into the tissues which has value, as foreign proteins are supposed to have bactericidal effects. Also hydrochlorids are sometimes a valuable therapuetic agent. However it may act, it is definitely very helpful in certain types of gingival infection when amebae gingivalis is present.

It must be remembered that the gingival trench is a definite part of the alimentary and respiratory tracts, and the interrelation is very close in disorders of these parts; also, it must be remembered that the resistance of the tissue in the gingival trench is often determined by the $p_H$ value of the local area involved, as well as the $p_H$ value of the whole metabolic interchange. This is not a mere academic problem, but one to be reckoned with in treatment, local as well as general. The $p_H$ value must be kept within the normal limits if the problem of subgingival therapy is to be wrestled with effectively.

I have seen cases of general acidosis mistaken for severe ulcerogingivitis which cleared in a few days or hours when the normal acid base equilibrium was restored. In dealing with this particular aspect of the subject, my own range of experience has seldom called for any other treatment than a high vitamin diet in the form of orange juice, yeast and cod-liver oil, if the diet and hygienic habits of the patient were otherwise normal.

In the severer acidosis, such as accompanies starvation with dehydration or diabetes, appropriate treatment must be instituted. Keeping up the glycogen reserve with glucose helps in very severe cases in which shock or stress produces the acidosis, but this type of case will seldom have to be wrestled with in office practice.

Subgingival therapy rests on the use of a specific or near-specific introduced to the point of incubation for the causative organism without an appreciable dilution of the medicament used. The medicine is introduced by the use of a suitable rubber cup attached to a contra-angle porte polisher or a hemostat. The cup is filled with the agent, contact is established with the tooth and the edge of the rubber is introduced under the free margin of the gum by a pumping motion, adhesion resulting, which enables the applicator to be carried into the deepest pocket and the drug expelled. This method may be used for obtaining smears and cultures as well as permitting the operator to convey the specific or near-specific under the gingiva to the point where actual destruction of the osseous or other structure is going on, or where a focus of infection is being established in

the form of a vulnerable resistance mechanism.

For the Vincent's organism, we are at present using arsphenamin, 5 per cent, in glycerin, and, in severe cases, the pure arsphenamin powder, 50 per cent by volume, with sodium perborate, 50 per cent by volume. The powder is used by touching the moist rubber cup to the preparation. A sufficient amount will adhere to the margin to permit medication at the point of active spirochetosis or other infection. The majority of minor streptococcic infections are controlled by introducing subgingivally a 5 per cent aqueous solution of mercurochrome. Application is made immediately prior to the use of arsphenamin. For the staphylococcus, we have found gentian violet, 0.5 per cent, and acriviolet in a 2 per cent solution, effective. For some of the gram-negative bacilli, the silver preparations have proved effective. For the ameba, we use one-half grain emetin hydrochlorid in 1 c.c. of an aqueous solution, hypodermically, employing the intramuscular injection. In some cases in which there is a local reaction from the intramuscular use of emetin, it is given intravenously. These treatments are used daily or weekly as the laboratory and clinical findings may indicate. Not only are topical applications made subgingivally to every tooth in the mouth, but, in acute spirochetosis, nasopharyngeal treatment is instituted, chiefly with 5 per cent arsphenamin in glycerin. At times, other organisms are present which require treatment; for instance, in those infections recognized as the result of regurgitation from the intestinal tract, in which magnesium sulphate, magnesium oxid or even a small dose of castor oil is effective. One must always keep in mind the unusual infection that may be associated with subgingival and other oral lesions. It is important that the clinical reaction be not confused with that which can be registered only by microscopic or laboratory findings.

In an approach to research in subgingival therapy, the larger field for which treatment may be instituted should be the prime objective and not the mere local condition. The vicious cycle associated with subgingival involvement may be primarily of subgingival origin. The disturbance produced may in turn aggravate the original cause, or the subgingival field may be purely a secondary matter. This is particularly true in an involvement which is a part of the focal syndrome. Our research has been directed toward determining the nature of the local reaction and under what condition subgingival involvement is a source, or a result, or incident to, the larger aspect of the prevention and cure of disease.

# RELATIONSHIP OF SYSTEMIC DISEASES TO CONDITIONS IN THE ORAL CAVITY*

By GEORGE L. LAMBRIGHT, M.D., Cleveland, Ohio

THE mouth is frequently the channel of disabling and sometimes fatal disease. Therefore, the physician and dentist must make a careful examination of this region. Their studies are not limited to the power of observation, but often include bacteriologic and roentgenologic examinations. All of us are convinced of the importance of preventing access of infection through the mouth by intelligent care of the oral cavity. My purpose, on this occasion, is to describe some of the lesions in the mouth that come under the dentist's observation. The teeth are only part of the organism, and some knowledge of disease is necessary on the part of the dentist.

Fig. 1.—Hereditary syphilis; showing hutchinsonian teeth, saddle nose and bosses on the frontal bones.

*Read before Northern Ohio Dental Association, June 5, 1929.

### ENDOCRINES

Before proceeding to the description of some of the diseases, it should be of value to refer to the effect of the various glandular secretions on the oral structures. All of us represent some glandular type, in which one may expect to find certain types of teeth, tongue and mandible, corresponding to the development of the long and short bones. The preadolescent hypopituitary patient who has premature ossification of the epiphyses with shortening of the long bones has a small retroussé nose, small spadelike hands, small feet, and very often, in the female, undevel-

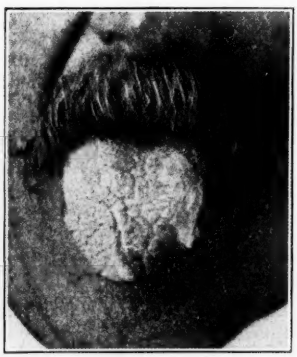

Fig. 2.—Leukoplakia of the tongue.

oped breasts. The teeth are also small, and are widely spaced and irregular in placement. In contrast to this picture, we have the hyperpituitary case, with large hands, long legs, large feet, widely spaced teeth, which are large and broad and pearly white, with overdeveloped mandible and large tongue. The case showing ovarian insufficiency usually presents large incisors, which are also broad and pearly white, as the underfunctioning of this gland allows the anterior lobe of the pituitary gland to become too active, and hence the mouth is very much like that in the hyperpituitary case.

Fig. 3.—Child with myxedema; showing edema of eyelids and malocclusion of the teeth.

In infancy and young adult life, malfunctions of the above mentioned glands are, no doubt, the reason for faulty eruption of teeth, and delay in the appearance of the teeth at normal age periods. This is the explanation of the presence of a tooth at birth. In the functional activity of the thyroid gland, it is observed that when the gland becomes inactive after the teeth have obtained full development, the resultant metabolic changes affect the function of the mouth. The teeth decay easily, tartar accumulates readily around the gums, the salivary secretions are diminished, and the tongue becomes coated and, in some cases, so thick that speech is interfered with. During pregnancy, the function of this gland is impaired, and there is active decay and pyorrhea. In cretinism, the thick tongue and changes in the teeth are well known. In overactivity of the thyroid gland, the mouth is again affected and the secretions are increased, but other changes are less marked. Frequently, severe herpetic stomatitis appears with menstruation, closely connected with some improper adjustment of the glands which affects the secretions and circulation in the

Fig. 4.—Hutchinsonian teeth.

mouth. Failure of glandular activity is the chief reason for the procession of extractions and the almost constant dental care which becomes necessary after the age of 40 years. Nature abandons us in maintaining health in the mouth, as she does in other parts of the body in maintaining adequate circulation, and it may well be said that we are as old as our glands instead of our arteries. It has been shown by several investigators that cholesterol degeneration begins early after the failure of the thyroid gland, and from here it is only another step to calcium degeneration.

NUTRITIONAL DISEASES

Nutrition is an important factor in maintaining a healthy mouth, and is a problem regarding which there is much inaccurate information, except as regards rickets. This condition delays dentition and softens the teeth. Scurvy manifests itself early in the disease in swelling, redness, bleeding and tenderness of the gums. It is not common, but appears sometimes in the most unexpected manner. My most recent case, seen a short time ago, was in a child who had been severely ill with whoopingcough, which rendered it difficult to maintain a sufficient diet. The child took milk, but no orange juice or fresh fruits. The first symptom was tenderness in the muscles of the legs. Within a few days, the gums were characteristically swollen and red. Their normal condition returned within a few days when orange juice was given. Pellagra produces reddening of the tongue, which resembles that associated with scurvy and pernicious anemia, except that the redness is confined more to the margins. Pellagra is seen occasionally in this climate. In sprue, there is still some question as to whether the nutrition is at fault or an infection is present. A grayish white, tenacious deposit appears on the tongue. The stools are pultaceous and greasy, and there is marked anemia of the pernicious type. In some cases, *Monilia psilosis,* a yeast-like organism, can be obtained from tongue scrapings. Nutritional deficiency, with chronic disease, affects the normal function of the mouth as well as the mineral and vitamin content of the body. The mouth becomes dry, secretions are changed and the teeth decay readily. The tongue becomes coated and the breath fetid, from changes in the body metabolism.

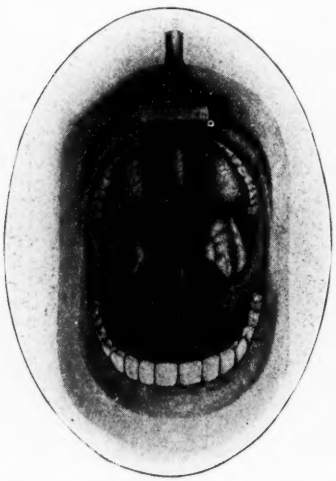

Fig. 5.—Vincent's infection of the tonsils.

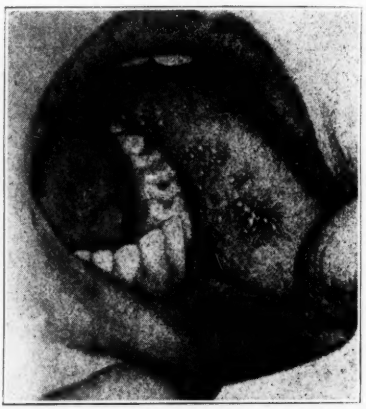

Fig. 6.—Koplik's spots; showing small yellowish pinpoint eruptions on the buccal membrane.

INORGANIC MINERAL POISONING

Lead poisoning can be discovered by the dentist who is familiar with the lead line around the gum margins, which is present in approximately 40 per cent of the cases. The line is bluish black, and if

a magnifying glass is used to examine it, the line will be found to be composed of many fine blacks deposits. A somewhat similar line can be produced by other minerals, but other changes in the gums, such as swelling and hyperemia, will help in recognition of the effect of other minerals, such as mercury poisoning. Phosphorus poisoning produces necrosis of the jaw, called "phossy jaw." It may be encountered in those persons who are engaged in the manufacture of fireworks and matches.

INFECTIOUS DISEASES

The contagious diseases have their on-

Fig. 7.—Phosphorus necrosis of the jaw.

set in most cases through the mouth, and occasionally the dentist may have the opportunity of observing the first signs. Measles produces a small reddish yellow papule in the buccal membrane and soft palate which is diagnostic from twenty-four to forty-eight hours before the eruption appears. The papules were described by Koplik of New York, and are called Koplik's spots. Scarlet fever and other streptococcus infections of the pharnyx cause a reaction on the part of the cells of the pharnyx which is in the nature of a local anaphylaxis with edema, pain and redness. The systemic evidence in the form of an erythematous rash is found from twenty-four to forty-eight hours later. A child may have a slight cold and small vesicles may be noted in the mouth. The finding of vesicular eruption on the face and body may lead one to suspect chickenpox. Vincent's infection is well known to all dentists, and is easily diagnosed by staining a slide of the exudate with dilute carbolfuchsin solution. Sometimes, a deposit occurs on the tonsils as well as the gums, and, when on the tonsils alone, may resemble diphtheritic mem-

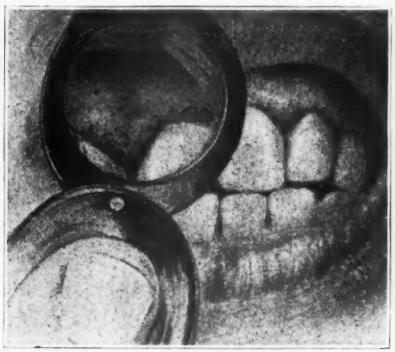

Fig. 8.—Lead poisoning; showing small metallic deposits in the gums.

brane. Thrush probably is not seen by the dentist. Once seen, it is never forgotten. The child's tongue is covered by a milky white deposit, which is easily scraped off. Cure is promptly obtained with boric acid solutions applied regularly to the tongue. Chronic infections of the tonsils and sinuses may aggravate gingival infections. One frequently finds an ameba in the secretions from the gums. Its rôle as a pathogenic organism has not been proved, as it is usually *Endameba coli*. The effects, on the general health, of

chronic infection at the roots of the teeth and in the gums is a subject in itself and cannot be discussed in this review. Both the physician and dentist should be familiar with the lesions of syphilis in the mouth. The most common sign is the mucus patch, which is a small superficial ulceration, sometimes with small whitish deposit, appearing on the side of the tongue and cheek. It follows the initial lesion, and is a secondary manifestation. If it is accompanied by eruption on the skin, it is readily diagnosed. Chronic or tertiary lesions may destroy the pillars over the tonsils or the soft palate. The tongue may show dense scars. The teeth

Fig. 9.—Tongue in sprue; showing whitish deposit over the surface of the tongue.

in hereditary syphilis are notched, and the cuspids are sharply pointed, with defective enamel. One should look for other evidence of syphilis, such as depressed or saddle nose, bosses on forehead and cloudy areas in the cornea of the eyes. Quite often, the child so afflicted is undersized. The dentist cannot diagnose syphilis by the appearance of the teeth alone, but encounters only suggestive evidence. Tuberculous infection of the tongue and mouth is found occasionally. The deeply infiltrated and sometimes ulcerating lesion of tuberculosis of the tongue or lip is often mistaken for cancer or syphilis when the condition is primary. If it occurs as a secondary manifestation of the disease, the lesion may be more easily suspected. The diagnosis is made by microscopic section. Tuberculosis is also fairly common as a primary infection in the tonsil.

### DISEASES OF THE BLOOD

The beefy redness of the tongue occurring in pernicious anemia is highly suggestive, and physicians are familiar with the importance of observing the tongue when the disease is suspected. It is not absolutely diagnostic, and has been seen without the other diagnostic criteria. One can feel fairly certain with its presence that there is an absence of hydro-

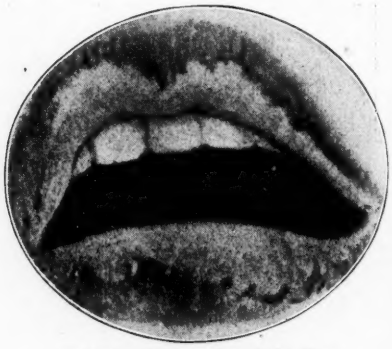

Fig. 10.—Diphtheria of the lips.

chloric acid in the stomach. On the other hand, a simple anemia will show pallor not only of the tongue, but also of the mucus membrane of the mouth and gums. In leukemia, the most characteristic change in the mouth is marked by severe gingivitis and hemorrhage from the gums. Accompanying the bleeding from the gums, there are other points of bleeding, as from the nose, eyes or rectum. The dentist may well suspect leukemia when large hemorrhages occur in the mouth, but it is unlikely that the dentist will encounter the disease first. It is sufficiently important that the dentist know about it,

for I have seen the dentist extract teeth in this disease; which only aggravated the condition. Agranulocytosis is a blood condition probably caused by an infection with *Bacillus pyocyaneus,* which is fatal, from paralysis of the hematopoietic system. It is classed as a blood disease and begins with large ulcerating lesions in the throat and mouth, which become gangrenous. The leukocytes of the blood will fall below 1,000 per cubic millimeter before death. Polycythemia is a blood disease in which the red blood cells and

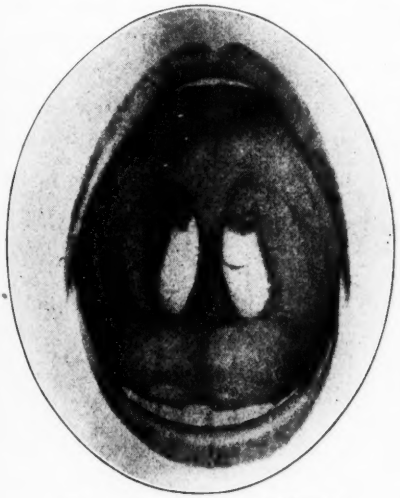

Fig. 11.—Pharyngeal diphtheria.

hemoglobin are greatly increased, the skin is reddish purple, the blood pressure is increased and spleen is enlarged. The color of the mouth, lips and tongue, with high color in the cheeks, would suggest to the dentist that his patient had an abnormal condition which was affecting the oral cavity. It is not common.

### FETOR ORIS

Patients often come to us with a chief complaint of bad breath, and they almost invariably attribute it to disorder of the bowels. This is seldom the source of the trouble and the tradition is not upheld by experience. Tonsil, adenoid and mouth infections may be local causes, but the source, as a rule, is faulty metabolism, with execretion of waste products through the mouth. In chronic heart and kidney disease, the breath is fetid. Diabetic acidosis produces a characteristic odor, peach seeds. Stagnant urine in bladder from prostatic hypertrophy produces a urinous odor of the breath. Certain foods in their process of metabolism produce odors on the breath, and the dentist must be familiar with this. The tongue is coated in gallbladder and liver disease. This is often a valuable point in the differential diagnosis of ulcer of the stomach and gallbladder disease, as the tongue in uncomplicated ulcer is clean.

### CANCER OF THE MOUTH

The lesion of cancer is found on the margins of the tongue and the lip. It is more common on the lower lip. Dentists can assist in the prevention of this condition by eliminating points of chronic irritation and by so placing their crowns and plates as to avoid it.

### CONCLUSIONS

Important factors governing the development, health and diseases of the mouth have been discussed as seen in the practice of medicine with the hope that the dentist's interest will be aroused and early evidence of systemic disease be elicited. A knowledge of systemic disease will give the dentist a much broader insight into conditions within the mouth. This knowledge will prevent the spread of contagious disease, send his patient to his physician when he recognizes evidence of systemic states, and prohibit him from performing operative procedures in the face of serious blood diseases, which may hasten the death of the patient.

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## *Editorials*

### INTO THE HEART OF THINGS

For an example of downright service in a pioneer field where it is most needed, we call attention to the articles in the department of Dental Health Education in this issue, one entitled "Romance in Dentistry," by Harry S. Thomson, field secretary of the Canadian Dental Hygiene Council, and the other by Frank I. Livingstone, on "Back of the Last Frontier." These are two of the most human documents that we have ever read. Aside from the interesting and picturesque presentation, there is enough solid meat in these articles to give us pause and make us wonder if many of us have learned what real sacrifice is in this mouth hygiene movement.

Dr. Thomson has done outstanding work all over the Dominion of Canada in carrying the message of mouth hygiene to the people, and he has not stopped with towns and cities but has reached out with his propaganda into the remotest sections "beyond the end of steel." He has shown in his article his method

of approach in launching a community campaign, but manifestly he has not told the inner stories of all the finesse that must be used in winning over reluctant community officials, who in most instances are uninformed as to the significance of mouth hygiene, and in some instances are in decided opposition to any such movement. The first great task in starting a mouth hygiene campaign is to convince public officials of its desirability, and to enlist their enthusiastic support.

The most insistent demand of the day in this work all over the land in every country is to disseminate information to those in authority and to the people themselves as to the value of early and regular attention to the teeth of children, and while the most spectacular and appealing features of the service relate to the relief of suffering in those remote sections where there have never been any facilities for relief, the real problem is to so educate the people that these appalling cases of neglect and constant suffering may be avoided in the future. And there is no kind of education equal to the actual demonstration of sanctified service as outlined in Dr. Livingstone's presentation.

Conditions such as he depicts are enough to make the reader want to leave his city practice, his electric engine, his steam heated office, drop his editorial blue pencil and go out into the wilds and have a part in this wonderful work. "Cases? Six-year-olds with abscesses draining through the neck. Thanks be for the resident physician and his ether bottle. Chewing on nerves that had suffered so long that they had grown out of the tooth and covered themselves with a tissue coat to withstand the shock of mastication. Teeth twisted and turned; double sets decayed; teeth causing stuttering and appearing in almost all places in the mouth —all stages of decay—teeth at their worst."

There is no recompense of professional life quite equal to that of looking into the face of a little child who has been suffering untold torment from diseased teeth and has suddenly been brought relief. The sight of a heap of glittering dollars can never equal that, and when the real rewards of professional life are subjected to appraisal, it will be found that, after all, money

plays an insignificant part as compared with an experience such as that of Dr. Livingstone in the far stretches of the frozen north.

One sees humanity at its very best in these remote places. It is there that sacrifice has its most sublime expression, its most transcendent joy. It is there that selfishness is winnowed out of the human heart, and the real brotherhood of man is made manifest. It is there that the actualities of life grip the soul, and the sordidness and greed and petty meannesses of humanity are swept away by the grim hand of suffering and of sorrow; and the beneficent hand of sympathy and loving service.

Let those who are inclined to cavil at the small inconveniences of life, who complain when their coffee is cold, or they are crowded in a street car, or the delivery boy is a trifle late; let people of that type go with Harry Thomson or Frank Livingstone for just one trip into the far recesses of the remotest outpost of civilization and see the conditions under which people exist; let them look in the mouths of little children and see such appalling evidence of neglect and of suffering, with pulps hypertrophied and seared over "to withstand the shock of mastication," and then let them witness the community of interest that exists among these people, the helpfulness toward each other, the willingness to sacrifice one for the other, the expedients that must be used to meet the ever-recurring emergencies that arise in the limited lives of the pioneers; let them for once get down into the heart of things and see if there is not some sanctification in it, some incentive for more unselfish living, some thrill from reaching out the hand to succor one's fellowman.

It will be a proud day for dentistry when the spirit of unselfish service permeates the entire mouth hygiene movement throughout the world, when the real significance of this service is made manifest to the people everywhere, when we have climbed over the hill of our present difficulties and met our emergencies in the way of relief of existing disease and suffering, and have gone out into the fairer fields of prevention and checked the oncoming tide of dental disaster, so that men, women and little children shall no longer live under the handicap of this universal

scourge of the human race. When that time comes, our profession may hold high its head among the beneficent callings of the earth; but not till that time does come.

All honor to the men and women of today who are laboring toward this fortunate end, laboring with a vision, an enthusiasm and an unselfishness that constitutes itself one of the most outstanding services in the general betterment of the race. Our congratulations to all of those who are responsible for the mouth hygiene movement in Canada, and our best wishes for their continued success.

## THE STATE OFFICERS CONFERENCE

The State Officers Conference of the American Dental Association has now become an established institution in the affairs of our organization. Annually, it brings together the men at the head of the various state societies in a conference where the best interests of the state organizations and the parent body may be discussed freely and contructively. Each state has its problems, and these problems may be brought to the conference where they are frankly considered for the benefit of all. Thus, one state may help another in a very tangible way, and all of the states may help the central organization. Conferences of this character have been of the greatest value in the past, and if the spirit is kept up that has always animated them, they will be even more valuable in the future.

The conference which met on Jan. 12, 1930, was a most enthusiastic gathering. Various topics of mutual interest were discussed and the allotted time was fully occupied. A message was presented from the Local Committee on the coming meeting at Denver. The plan was outlined for the clinical program at this meeting, and the Relief Fund was quite generally discussed. The latter topic is one of unusual interest, and it always elicits an interesting discussion. It seems difficult for the average member to understand just how this fund is secured and how it is administered; but gradually the members are becoming in-

formed, and when they are thoroughly familiar with it, there will be little difficulty in raising the fund to the amount originally intended. At least half a million dollars will be required to make the fund fully effective, and our members should not stop short of this amount.

The new group insurance plan was discussed at length, and this is another activity of our organization that, when understood, will make a strong appeal to our members. Other topics were considered, such as the community of interest between the dental supply industry and the profession, a subject that is always worthy of careful deliberation; "The Value of State and Component Society Conferences," "Importance of Intensive Membership Campaigns," "Advantages of State Officers Conferences," "Methods of Financing Meetings," Etc. Considerable attention was given to the subject of "A National Survey of Dental Income," and the plan was outlined for cooperating with the Committee on the Cost of Medical Care. At the Washington meeting, a committee was appointed for this purpose, and it is now actively engaged in organizing a nation-wide survey of this economic phase of our practice. The subject of dental economics is much to the fore at this time in society deliberations, and it is hoped that this survey will give us new light on certain of our economic problems, and help to point the way to a better adjustment of our material interests.

All in all the recent conference must be counted a success in every way. Each year, there is a slightly different atmosphere to these meetings owing to the fact that, of necessity, the personnel of those in attendance is constantly changing, and new men are continually coming into office in our state organizations. This makes it all the more important that these meetings be held each year, as the new state officers are thus enabled to become acquainted with their duties and their various problems. It is only through such a medium that good team work will prevail and the best results accrue, not only to the state organizations, but to the parent body as well.

## A NEW ROOT FILLING

In all the agitation over the pulpless tooth, there has really been little in recent years that is new in the way of methods of or materials for filling root canals. In the past, much time and effort were devoted to this important operation, but, up to the present, nothing of striking importance has been advanced for years.

It has remained for Howard T. Stewart, of New York, to introduce something novel and even revolutionary in this operation, and to present it to the profession for their consideration. Dr. Stewart's paper in this issue (page 381) will be read with much interest by those who are concerned with the preservation of the pulpless tooth, and whether or not the reader will agree with the author, the fact stands out in vivid insistence that if the roentgenogram tells anything like a true story, there is something in the method that must be reckoned with. The pictures here published are only a tithe of those in the possession of the editor, and all of them show the same satisfactory results so far as roentgenographic evidence is concerned. Dr. Stewart has taken all sorts of desperate conditions and subjected his method to the acid test of clinical experience. He has accepted cases avowedly hopeless and filled the teeth experimentally—teeth that he condemned for extraction before filling—and then studied the results. The most remarkable developments are shown in the very general improvement of the tissues following the filling, indicating that at least the tissues are very tolerant of the material.

This method has not been in use for a sufficient time to permit of a pronounced verdict as to the ultimate outcome. To this, we are certain that Dr. Stewart himself will be only too glad to subscribe, and yet we have the feeling that any method with the record of successes that have accompanied this one thus far must claim a fair measure of respect, and the least that can be said is that it merits a further test and a very serious study of results. This is what Dr. Stewart desires, that the method be taken seriously by the profession and subjected to such wide-

spread experimentation that its ultimate status shall be definitely established in the reasonably near future. It is so radically different from any other method thus far advanced that it merits the careful consideration of many men, and this is the only way by which a just decision as to its value can ever be made.

In this connection, the fact may as well be faced at once that the real basis for judgment in the management and behavior of pulpless teeth, as in any other line of practice, is long and carefully checked clinical experience. No other kind of evidence can ever take the place of clinical facts well authenticated. All the theorizing in the world will never weigh in the balance against clinical findings, and when this question of the status of the pulpless tooth is finally settled, it will be done in the clinic and the office rather than with the test tube and the microscope. Valuable as these adjuncts are, they can never take the place of the story told in the mouth, where the reactions of the tissues themselves are brought into play, and exert a potent influence in the final results. Let us study clinical records more and resort to theorizing less.

## THE ASSOCIATION AND DRUG REFORM

The American Dental Association has taken another forward step to aid the profession in protecting the public and to raise the standards of usage of dental drugs and remedies. The latest step is one in the series of actions by the House of Delegates and the Board of Trustees to bring about the necessary machinery to fulfil these desired objects.

A little less than two years ago, the A. D. A. Bureau of Chemistry started its work for reform. To judge from the number of commendatory letters received by the Bureau, the profession is more than eager to have the knowledge which will enable it to combat fraud and the abuses which arise in connection with the exploitation of some dental remedies. The second forward step was the creation of the Council on Dental Therapeutics, to which

attention has been called in a recent issue of THE JOURNAL.[1] The caliber of investigators represented on the Council is such as to inspire confidence in the work to be accomplished by them in the protection of the profession and public and in their endeavors to lift dental materia medica from the Augean stables in which it has so long rested. Additional protection is given to the profession by a recent action of the Board of Trustees. Acting at the request of the Council on Dental Therapeutics, the Trustees enacted the following resolution, among others, in this crusade for betterment of the dental drug situation:

1. That, after July 1, 1930, advertising of proprietary remedies in THE JOURNAL will not be accepted unless the product and the advertising have been accepted by the Council, except in such cases as existing contracts legally obligate the Association to continue advertising copy until the conclusion of the contract.

2. That the Business Manager be advised not to accept for exhibit in the commercial exhibit proprietary remedies which are not acceptable to the Council on Dental Therapeutics on and after 1931, and that after 1931 journals carrying advertising matter relative to products not acceptable to this Council shall not be accepted as exhibitors.

The import of these resolutions promises much for the future weal of the profession. As soon as the intent of these resolutions is entirely effected, a reader of THE JOURNAL will be reasonably sure that advertising of proprietary remedies in THE JOURNAL has been admitted only after it is found to comply with the rules of the Council, primarily designed to protect him and the public which he serves; and that they are worthy of his attention. In this regard, the Association will endeavor in the interests of the dental profession and the public to enlist the cooperation of manufacturers of worthy dental products, designed either for therapeutic or oral hygiene uses.

In connection with the commercial exhibits, the members attending an annual session will appreciate that the products ex-

1. The New Council on Dental Therapeutics, editorial, J.A.D.A., 17:337 (Feb.) 1930.

hibited in the convention are those which have been admitted only after a careful scrutiny of their composition and claims. Members will not be importuned to use this or that untested or overexploited product. They will be reasonably sure that what is exhibited there keeps good company. Progressive manufacturers too, no doubt, will welcome this step.

In the final analysis, whether or not the Association is to succeed in its efforts to protect itself and the public depends in large measure on the profession itself. The Council will furnish the facts to the profession. The profession, having these facts available for their guidance in the practice of rational dental therapy, will be readily enabled to separate the sheep from the goats. In this connection, we commend the spirit which prompted the editorial in the *Bulletin of the Chicago Dental Society* in which it was stated:

"They can perhaps be promoted by the appointment of two types of committees, and the American Dental Association should consider actively fostering such action. In every state and large component society, a committee should be appointed to promote interest and enthusiastic cooperation with the Council and the Bureau by articles in local bulletins, by discussion before society meetings and such other means as may be employed to acquaint the profession with scientific information so essential to the proper and honest practice of dentistry.

"The other type of committee should be developed in the larger centers where groups of scientific men, with available facilities, can be interested in active cooperation by investigation of products under consideration. In this way, the Council can more rapidly extend its scope and complete certain necessary investigations."

Dental history is now being written. All far-seeing and progressive members, we are very sure, will wish to cooperate in correcting some of the abuses that have almost imperceptibly crept into the profession in connection with dental materia medica.

## A LAW THAT HAS CAUSED COMMENT

Much comment has been created over a law passed by the legislature of the State of Arizona to regulate the practice of orthodontia in that state, whereby provision is made for licensing to practice orthodontia persons who have not graduated in dentistry. This law states that "the board of dental examiners and two practicing orthodontists, appointed by the governor, shall constitute the examining board for orthodontists, which joint board shall have and exercise all powers of supervision and license of orthodontists as the board of dental examiners have with respect to dentistry."

To sum up in brief, it is apparently the purpose of this law to empower an individual to practice orthodontia without the slightest reference to his knowledge of the fundamentals of the broad field of dentistry, and we have the feeling that these fundamentals are so important that it is a retrogressive step to ignore them. Without taking the time to go into the merits or demerits of this question, it may be stated that it is often a very easy thing to pass unfortunate legislation in matters on which the legislators cannot be expected to be intimately informed, and whenever such legislation is once on the books, the only logical thing is to work for a repeal. We understand that it is the purpose of the thinking men of Arizona to attempt an appeal at the next legislature, and in view of the widespread opposition which this bill has called forth from those most interested, viz., the orthodontists themselves, we can only hope that the attempt will be successful. No bill can be right or equitable that raises the general opposition that has been caused by this bill, and we hope that our friends in Arizona may succeed in having it taken off the books.

## FURTHER CONTRIBUTIONS TO THE RELIEF FUND

In addition to the receipts reported in the January issue of THE JOURNAL, the Association acknowledges the following:

Brooklyn Dental Society ..... $ 50.00

| | |
|---|---|
| First District Dental Society, New York City | 150.00 |
| Iowa State Dental Society | 100.00 |
| Kansas City Dental Society | 24.00 |
| Missouri State Dental Society | 150.00 |
| Second District Dental Society, New York City | 150.00 |
| Oregon State Dental Association | 50.00 |
| St. Louis Dental Society | 200.00 |
| Washington Study Club | 73.53 |

*Commercial Houses*

The contributions from eighty-four commercial houses aggregate $1,623.00.

## EXTRACT FROM THE ADMINISTRATIVE BY-LAWS

The following extract from the Administrative By-Laws of the Association, Chapter I, Section 3, is self-explanatory:

> "Sixty (60) days after January 1, the General Secretary shall drop from the membership roll the names of all whose dues for the current year shall not have been received."

It will therefore be necessary to discontinue mailing THE JOURNAL to those members who are affected by the foregoing regulation.

This is the last issue that you will receive unless you have paid your 1930 dues.

# COUNCIL ON DENTAL THERAPEUTICS

## STATEMENT OF SCOPE OF THE COUNCIL

The Council has authorized publication of the following statement.

SAMUEL M. GORDON, *Secretary.*

THE Council on Dental Therapeutics of the American Dental Association is to be a permanently functioning body to advise the dental profession and the public concerning dental proprietary or nonofficial remedies and materials in regard to composition and therapeutic usefulness. Its endeavors will be directed toward the goal of protecting the dental profession and the public against fraud, undesirable secrecy and objectionable advertising in the marketing of proprietary and nonofficial articles.

In pursuance of this object, the Council shall examine articles on the market as to their compliance with rules. The rules will be announced at a later date. In order to give expression to these objects, reports of the Council will be published in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION from time to time.

The decisions of the Council on Dental Therapuetics are to be based on careful and unbiased examination (in the light of available evidence) of dental proprietary articles, as to their compliance with definite rules designed to prevent fraud, imposition, undesirable secrecy and the abuses which arise from unwarranted advertising.

For the present, reports of the Council to be published in THE JOURNAL will, in the main, fall into two classes: those dealing with drugs or drug preparations which are found to comply with the rules of the Council; and those dealing with drugs or drug preparations, nonofficial remedies, conflicting with the rules of the Council. Nonofficial drugs or preparations which are found to be acceptable, that is, those complying with the rules of the Council, will be included in the list "Accepted Nonofficial Dental Remedies" (abbreviated A. N. D. R.). This list, as previously mentioned, will appear in THE JOURNAL, and possibly at a future date reports may be collected in book form. Those which do not comply with the rules of the Council may be considered as unworthy the dentist's attention. Later, it is anticipated that the Council will consider other dental products, such as porcelains, cements, amalgams and physical therapy apparatus.

The Council will endeavor, in the interests of the dental profession and the public, to enlist the cooperation of manufacturers of worthy dental products, designed either for therapeutic or oral hygiene use.

In the furtherance of rational dental therapeutics, the Council will consider, within its scope, publishing in THE JOURNAL articles bearing on the present status of debatable therapeutic procedures as well as articles on the general status of dental therapeutics. It may also initiate clinical investigations where the action of the

Council depends on clearing up debatable points as far as general consideration of therapeutic actions are concerned.

The Council holds itself ready to function as an advisory body to the dental profession on scientific questions within the general scope on dental therapeutics, and other remedial procedures.

The examination of outright dental nostrums advertised to the public may remain as heretofore a function of the present American Dental Association Bureau of Chemistry.

The scope of the Council may be changed as circumstances and the interest of the dental profession and the public demand.

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## REPORTS OF THE COUNCIL

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

### PERDENTIN NOT ADMISSIBLE TO ACCEPTED NONOFFICIAL DENTAL REMEDIES

Perdentin is a proprietary of secret composition marketed by Perdentin Laboratories, Inc., New York City, to the dental profession. The extensive advertising of Perdentin in certain dental journals, the unusual claims made for it, and the considerable number of inquiries from dentists concerning the product caused the Council to inquire into the composition of and the therapeutic claims for the product.

The advertising literature states Perdentin to be

> the newest local anesthetic—called by dentists "the ideal pain preventive."
>
> Perdentin applied with a pledget of cotton successfully eliminates pain in all minor procedures, such as pain of extracting pulps, pain of injection, lancing abscesses, extracting deciduous teeth, scaling, prophylaxis, cavity preparation, post-operative pain, etc.
>
> Its quick action will delight you no less than its powerful penetration. Within 10 seconds after applying it, you can proceed with the operation.

In view of our knowledge of the actions of local anesthetics, which are freely marketable, these claims are startling and miraculous.

Perdentin is claimed to be "a nonsynthetic, nonirritating, colorless liquid, compounded of alcohol-benzylic-trichlor-menthanat, possessing highly antiseptic and healing properties."

Samples of Perdentin were obtained in the market and examined by the A. D. A. Bureau of Chemistry. Investigation indicated that Perdentin consisted of 3 parts by volume of benzyl alcohol and 2 parts by volume of chloroform. Alkaloids were not found.

From the chemical examination, Perdentin appears to be nothing more than a mixture of two well-known drugs, whose properties and actions are well understood. The properties of chloroform are described in the U. S. Pharmacopeia and of benzyl alcohol in New and Nonofficial Remedies of the A. M. A., and the actions of both substances are described in current textbooks on pharmacology.

Chloroform is used as a systemic anesthetic, and benzyl alcohol, as a local anesthetic. Applied locally, both substances, in undiluted form, act as irritants, the

irritant action being reduced by dilution. A 4 per cent solution of benzyl alcohol in water is practically nonirritant, but this would not be the case with a solution in chloroform, and a strong solution such as is represented in Perdentin would certainly be irritating. Such irritating solutions, and indeed chloroform itself, are commonly employed as counter irritants for the relief of localized pain as in toothache and sprains. Although both chloroform and benzyl alcohol may act as local antiseptics, they are not employed in this way, nor for the promotion of healing, because they do not compare as to desirability and efficiency with other well-known antiseptics.

In view of the fact that benzyl alcohol can act as a local anesthetic, the Council requested Dr. Harold T. Dailey, instructor in pharmacology, Northwestern University School of Dentistry, to compare the local anesthetic efficiency of Perdentin with known mixtures of benzyl alcohol and chloroform and with benzyl alcohol alone for pain in dental conditions and operations. The comparison of four specimens sent for testing was unknown to Dr. Dailey until after the results were summarized. No. 1 was a mixture of equal parts by volume of chloroform and of benzyl alcohol; No. 3, a mixture of 65 parts by volume of chloroform and 35 parts by volume of benzyl alcohol; No. 4 (Perdentin) and No. 5, a mixture of 75 parts by volume of chloroform and 25 parts by volume of benzyl alcohol. The benzyl alcohol was labeled as such. The solutions were applied according to the directions for using Perdentin.

The results of the tests with Perdentin and the three mixtures of chloroform and benzyl alcohol in twenty human subjects were identical. Local application resulted in very superficial anesthesia only and did not prevent the usual slight sensation of pain accompanying the introduction of the hypodermic needle as in the technic of local anesthesia. From 20 to 25 per cent of the patients complained of pain in some degree after the application of the benzyl alcohol-chloroform mixtures and of Perdentin, whereas only about 8 per cent, or only one out of thirteen patients, treated with benzyl alcohol reported slight pain. Complaints of irritation and soreness occurred after all the solutions were applied high up under the lip, and no solution was satisfactory for use in the lancing of abscesses. Local anesthesia was not demonstrable in sixteen dogs receiving local applications of the same solutions used in the patients, when applied to the oral and nasal mucosae, stomach and testicles.

Clearly, therefore, Perdentin is not efficient or reliable as a surface anesthetic for mucosae and viscera. This is as would be expected from the composition of Perdentin. The most that could be expected would be a comparatively weak local anesthetic action from the benzyl alcohol, but this action is reduced or prevented by the irritant action of chloroform, the other component of the mixture. Thus, not only is the inefficiency of Perdentin accounted for, but it is also seen to be irrational as a mixture for local anesthesia. In any event, the use of a mixture of benzyl alcohol and chloroform as an anodyne for toothache is not new, as it was suggested by Macht in 1920.[1] The use of benzyl alcohol, or a mixture of benzyl alcohol or chloroform, for local anesthesia by infiltration in minor surgical procedures is at least ten years old. The use of from 1 to 4 per cent of benzyl alcohol in normal saline

1. Macht, D.I.: J. A. M. A., 75:1205 (Oct. 30) 1920.

solution or in water is also well known. Hence, the manufacturer's claims that a mixture such as is represented in Perdentin is the "newest local anesthetic" and "less than two years ago Perdentin was new" are contrary to knowledge on the subject.

It is inexcusable for a manufacturer to appropriate a formula of well-known drugs, dress it up with a misleading and noninforming name and sell it to the profession at an exorbitant price, as a secret remedy. The reasons for the secrecy may be readily understood from the fact that an amount of Perdentin costing approximately $60 may be made for slightly more than $2, the retail price of one "full size" bottle of Perdentin.

If a dentist feels that a local anesthetic with the properties of benzyl alcohol, either alone, in aqueous solution, or mixed with chloroform, is indicated, he will do himself justice by using it as such and save himself and his patient needless expense. He also protects his own interests by not exposing himself to a poor defense in the event of suit for malpractice. Aside from scientific considerations, the use of a secret remedy by a dentist would have an unfavorable effect on a jury.

The Council desires to call attention to the fact that Perdentin is marketed in violation of the amended Food and Drug Act of 1906, since the label contains no statement of the presence, or amount, of chloroform in the mixture.

Since Perdentin is a secret, proprietary mixture, without originality in composition, and the therapeutic claims for it are greatly exaggerated, misleading and unwarranted, it is declared inadmissible to Accepted Nonofficial Dental Remedies.

# BUREAU OF DENTAL HEALTH EDUCATION

## ROMANCE IN DENTISTRY*

By HARRY S. THOMSON, D.M.D., Toronto, Canada

TO infuse something of the spirit of romance into dental history and dental literature, and thus create an interest in mouth health, is one of the fundamental objectives of the Canadian Dental Hygiene Council. This interest and romance are inspired by presenting to boys and girls the facts about mouth health in the language of development, athletics and happiness; by convincing mothers and mothers-to-be of the importance of prenatal diet, and its relation to the development of sound teeth in the unborn babe, and their value in its future life; by creating in the child, during the first seven years, a satisfaction and a delight in a clean mouth and teeth, and by convincing the adolescent boy and girl that a mouth filled with well formed, clean teeth not only means greater attractiveness and charm, but also helps materially to ensure health and success.

"Give light and people will find their way," is a proverb that might well be considered as the text which has inspired the council in its task of spreading throughout Canada from coast to coast, during the last four years, the story that the national menace of dental disease can be largely overcome through education. The educational program of the council does not consist in the presentation of some abstract theories to be accepted passively, but is built on scientifically established data and concrete examples, in the hope that it will inspire the individual to action, that action to consist of a definite effort on his part for better mouth health.

The practical or operative side of the work of the Canadian Dental Hygiene Council also has its romance. Mouth health education and dental services are carried to the hinterlands, to the outposts, to children under 12 years of age, who are perhaps 150 miles from a dentist, to children whose parents could not afford these services even if they were available, and this work carried on under cooperative auspices embracing the activities of every social health and welfare organization in the community. The story of the free traveling clinics unfolds a tale of unusual service rendered, of relief brought to suffering children, of knowledge acquired by them that will have a bearing on their future, important results accruing which even the greatest visionary would hesitate to estimate.

While oral hygiene and better mouth health are the immediate objectives of the council, of equal national importance is the secondary objective: that better mouth health lead to better general health. Clean and healthy mouths always indicate better average health and

*Canadian Dental Hygiene Council Province Wide Campaigns.

stronger bodies; stronger bodies mean sounder minds; sound minds think sane thoughts; sane thoughts inspire nobler patriotism; nobler patriotism creates better citizenship; better citizenship finally leads to a better and greater Canada.

The distinctly national aspect of the Canadian Dental Hygiene Council is manifested by a review of the personnel of its executive, its financial structure and the scope of its activities. It is endorsed by the dental societies of every province in the dominion, and by the Canadian Dental Association. A representative from every province in the dominion is a member of its executive board. It receives an annual grant from the government of the Dominion of Canada at Ottawa, from the Canadian Red Cross, from the Canadian Life Insurance Officers' Association, from the Canadian Oral Prophylactic Association and from various other philanthropic and charitable bodies.

The council was formed in January, 1924; a charter was obtained from the Dominion Government, and early in 1925 the council commenced to function. It is a national voluntary organization composed of laymen, with a subcommittee of dentists to establish dental contacts. Its officers are outstanding executives and business men. The president is a lawyer, a general who was minister of militia in the government during the World War. The vice-president is general manager of one of the largest life insurance companies in the dominion. On the executive council, the dominion Red Cross representative is a prominent engineer, a colonel who was connected with the department of sanitation and water supply of the British army during the World War. Another member of the executive council is the editor of one of the foremost newspapers in the dominion.

These men are busy men, men who have been active for years in public health and social welfare work, men who have been concerned in every important health movement in Canada, but yet they are so impressed with the importance of this mouth health movement in Canada, and with the importance of oral hygiene educational work, that they willingly give of their time and money to promote the welfare and program of the Canadian Dental Hygiene Council. In order to maintain close contact with the dental profession, one representative is appointed by the provincial dental association from each province. The council also has full authority from the Canadian Dental Association, whose president and secretary are ex officio members of the executive council.

The council maintains dominion headquarters in Toronto, which serve as a clearing house for all matters pertaining to oral hygiene, as well as a general bureau of information for everything pertaining to mouth health. On request, dentists, school teachers and social service and health workers are provided with outline lecture, slides, moving picture films, newspaper articles, health literature, charts and all other necessary material or equipment for the promotion of the work.

The outstanding aim of the Canadian Dental Hygiene Council is to undertake, each year, an intensive mouth health campaign, in some one province of the dominion.

During the past year, 1929, a province-wide campaign was carried out in the Province of Manitoba. A detailed report of this has been published and can be had on application. This report relates in detail how that task was accomplished.

Public addresses were delivered to the school children, clubs, groups and associations of many different types; thousands of booklets were distributed; newspapers published special series of informative articles; motion pictures told a pictorial story on the screen of scores of theaters; the radio broadcast special lectures; hundreds of school children wrote essays on the subject, and, most important, examinations of mouths were made among the members of the younger generation throughout all Manitoba.

The success of the campaign can best be exemplified by quoting from the official report:

> Service for all was the keynote of the Manitoba campaign, enthusiastic cooperation of all interests for one single service, the promotion of better health.
>
> Under the guidance of the Manitoba Dental Association and the Canadian Dental Hygiene Council, health, social and welfare organizations throughout the entire province were linked together. This, in the words of an official of the Provincial Government "made possible the greatest health campaign that has ever been put on in Canada."
>
> Primarily, the campaign was organized by the Canadian Dental Hygiene Council, but it was done at the request and with the supervision of the Educational Committee of the Manitoba Dental Association, under the auspices of the Departments of Health and Education, of the Manitoba Government, and with the assistance of the Provincial Red Cross, and the hearty cooperation of every existing social service, health and welfare organization in the Province. We received not only the sympathy but the active support and working assistance of all these bodies. The campaign was officially endorsed by the heads of the Government. These facts cannot be too greatly emphasized.
>
> Each and every one of these groups worked with a zeal and earnestness as great as that of the dental organization proper. In fact, it was their campaign, and not ours. It is not surprising then, that success was immediate and overwhelming. The success not only depended on the widespread interest aroused, but also on the valuable contacts established, and it may be assumed that the important results achieved, moreover, will be permanent and lasting.
>
> This success was due, first to organization; second, to cooperation; third, to the active interest of nearly every man, woman and child in the province; fourth, to the public eagerness for any educational material along general health lines, and finally, to the unselfish devotion of the entire profession of dentistry in Manitoba to the highest ideals of their profession.

The importance of working under the auspices of the departments of health and education of the provincial government cannot be overestimated. Any health movement must have the sanction of, and better still, work under the direct supervision of the department of health. Any educational effort (and this campaign was a combination of both) must necessarily be carried out with the authority of the department of education. The ministers of these departments were interviewed, and not only offered to cooperate, but also advised us that they were anxiously waiting for our suggestions as to how their departments could best assist to further the aims of the campaign.

The province was divided into eighteen districts, and a chairman appointed for each district.

About thirty days before the actual campaign date, a visit was made by the field secretary of the Canadian Dental Hygiene Council to each of the eighteen districts. The object of this visit was to aid in the formation of a program, to meet the heads of the various organizations in that local community and to confer with them as to the best means of reaching the greatest number of people with our message. At each meeting, a committee was formed to carry out the program. Such a committee usually consisted of seven members, of which not more than two were dentists. An attempt was made to have as members a local editor,

a representative of the Red Cross, a school inspector or principal, a representative of the clergy, and one or two representatives of commercial life. The mayor of the town, in a number of instances, was the chairman of the local committee. The varied interests of these different members greatly enlarged our contacts and forestalled any criticism that the campaign might be purely dental and solely concerned with the profession of dentistry. In passing, it is well to add that there was very little of this criticism. The broad spirit of the people of Manitoba resulted in our program being received as a purely unselfish one, promoted solely for the common good.

In preparation for the campaign proper, the department of health sent letters to every medical officer of health, and every physician directly or indirectly connected with that department, requesting assistance in any way possible, and whole hearted cooperation during the dates on which the campaign was carried out in their district.

The department of education sent a similar letter to every school inspector, principal and school teacher throughout the province, stressing the importance of health education and asking their help in the effort to reach every school child in Manitoba under the very best auspices.

Letters were also sent from the headquarters of the provincial Red Cross in Winnipeg to all local officials in the various districts, asking them to cooperate.

The director of the extension service of the department of agriculture and head of the women's institutes for the province sent letters to all leaders of that organization in the various districts, enlisting their cooperation in the program.

The headquarters of the board of trade in Winnipeg sent out similar letters to the various boards of trade throughout the province. Miss Russell, chief of the public health nurses, sent similar letters to all of the nurses in Manitoba.

These established contacts and interests which could be gained in no other way. The results were that, on the dates set, almost every individual in each community was aware of the fact that the campaign had begun, the names of its sponsors and its objectives. All were convinced, moreover, that they themselves should have an active part. The result was that there was not one single failure throughout the province; not a single meeting was a "dud." All were well attended; enthusiasm was high, and interest keen. From the north to the south, and from the east to the west, everybody was united in an effort to assist the Canadian Dental Hygiene Council, and the Manitoba Educational Committee in telling the story of oral hygiene and mouth health to the greatest number.

The extent of the program can best be realized by explaining in detail how it was made up.

The school children in the province were given an address of not less than fifteen minutes, on mouth health and the importance of oral hygiene and its bearing on proficiency and general health. This address was followed with a moving picture on the same subject.

Each child was given an excellently printed, well-illustrated book teaching mouth health.

Each child was given a mouth examination chart to take to his parents showing the condition of his mouth, with suggestions for treatment if necessary.

Each child was entitled to write an essay on mouth health, for which a prize of ten dollars was given in each district.

Public addresses were given to all meetings of service clubs, and women's organizations. Meetings for the general public were held. At these, a moving picture was also shown.

One hundred and five newspapers throughout the province carried a series of five articles on oral hygiene. The result of this program was that almost every individual in the province during the days of the campaign in their particular district was brought directly in contact with the importance of mouth health and its bearing on general and community health.

Through the cooperation of the dentists of the province, it was possible for us to carry out an inspection of the mouths of the children. This required two or three days of each dentist's time. The results were far-reaching, as it provided every child with a chart of his mouth condition which he took to his home. The chart outlined the condition existing, suggested treatment, and gave some general rules of mouth health.

The good accomplished by this one variety of effort was sufficient in itself to make the whole campaign worth while. Not only were children and teachers shown the need of mouth health through lectures, and the distribution of literature, but they learned the details of their own condition and discovered what bearing it had on their future, and also how it could be corrected.

In order that our campaign might not be entirely educational, it was decided to carry operative treatment to sparsely settled districts and remote areas where the people were entirely cut off from dental services. The province of Manitoba is largely agricultural; the towns in many cases are far apart, and large areas of country which is settled by new Canadians are anywhere from 40 to 125 miles from the nearest dentist. It was believed that we owed some duty to these people. We felt that it was of little use to send educational material to them without providing some means of taking care of the conditions existing. We felt that education without the facilities for treatment was of little value.

A large number of the new Canadians in these districts are totally unable to pay for dental services, even if these services were available, and on the basis of these premises, the free traveling dental clinic was established. A tremendous amount of detail work was necessary in order to have it properly organized. The conditions governing these was that only the needy should be taken care of, children under 12 years being given the preference but older children being cared for if there was sufficient time; and that the clinic should not be established where there was either a resident or a visiting dentist. In other words, the free clinic was not carried out for state dentistry; it provided services that could not be obtained otherwise. These conditions required a thorough analysis of the situation: (1) as to who were poor; (2) as to the location of dentists; and (3) as to where the greatest good could be accomplished. In this clinic, we had the aid of the combined efforts of the department of health, the provincial Red Cross, the women's institutes and the department of health nurses. The Canadian Dental Hygiene Council paid the salary of the clinician, the Manitoba Dental Association provided material and equipment, the women's institutes, Red Cross and department of health and the public health nurses worked out the itinerary, made all arrangements and provided maintenance and quarters for both the clinic and the traveling dentist. There is appended

hereto a detailed report of the work accomplished in the free traveling dental clinic, work that was more than worth while, work that brought happiness to the hearts of many mothers and smiles to the faces of many children, work that was of such far-reaching effect that time alone will reveal the extent of the good accomplished.

The great problem in such an effort as this is to obtain the services of a dentist to carry out the work of this free traveling clinic who has high ideals and a lofty vision. To enumerate some of the difficulties under which this work was conducted: The nature of the work done is not the most inviting. The work is almost entirely for children under 12 years of age. These children come largely from the homes of new Canadians who have not yet become accustomed to our habits of sanitation and cleanliness. The work is done only for the poor and the dentist has nothing to gain from point of contact (he is not practice-building). He is working for a small salary. He is working under tremendous difficulties and hardships in a province such as Manitoba in the winter time. He is only six days in one place and must pack and unpack, travel in slow trains with poor accommodations, and in more than one case finds it necessary to haul his entire outfit on a sled to the next clinic, some miles distant (the only means of getting there). The man to do this work must be sympathetic; he must be kind; he must have outstanding ability to do children's work; he must have all the attributes of virtue. In order that you may realize that we found just this type of man to carry on this work, there is appended hereto a report which Dr. Livingstone has made, covering forty days of work accomplished. Twenty-six days of work carried on by Dr. Deagle was under like conditions, and the one report will bring to you the atmosphere in which each of these men did his work and the spirit manifested.

And so the work of the council goes on. This year's big activity is a campaign in the Province of Alberta, which gives promise of being a still greater success.

To many individuals, these campaigns may seem to be but an expression of ideals, or an attempt to make practicable the realization of the ideal of health through education; but, to the dentist, it is a practical working out of scientific truths, truths that have been established on the sound basis of scientific research and carried out to definite conclusions. With this conception of the campaign before them, the dentists enter into the work with heads high and spirit fired with the enthusiasm of real service to be done. They view it as an opportunity of giving themselves for the time being as missionaries in a noble cause; namely, bringing better health and greater happiness to many people, particularly to little children. They give this service, not in the hope of financial reward, not for pay or fee, but that, in this way, they may render aid to the community and the nation, which could be done only by men of the highest professional ethics and personal ideals. And the men who are giving this service have caught the vision, and have found their daily work changed from the gray drab of routine to a life of glorious service, and they can say with Van Dyke:

Let me but do my work from day to day,
In field or forest, at the desk or loom;
In roaring market-place or tranquil room:
Let me but have it in my heart to say,
When vagrant wishes beckon me to stray,
"This is my work: my blessing, not my doom!
Of all who live, I am the one by whom

This work can best be done in the right way;
Then shall I think it not too great nor small
To suit my spirit and to prove my powers;
Then shall I cheerful greet the labouring hours,
And cheerful turn when the long shadows fall
At eventide, to play and love and rest
Because I know for me my work is best."

This is the spirit of romance that the Canadian Dental Hygiene Council is endeavoring to infuse into the history and literature of dentistry.

## BACK OF THE LAST FRONTIER

By FRANK I. LIVINGSTONE, D.D.S., L.D.S., Oak Park, Ill.

TO the traveler of pavements and highways seldom comes the realization that these trails have been blazed by pioneers. Less often do we realize that pioneers are still fighting the age old battle for home and progress on the last frontier of this continent. Frontiers shift, and with them go those in whose blood is the lure of the unknown. The West has been conquered, and now the fight is on to claim the North.

To these pioneers must be brought the medical arts. The Red Cross, missionary societies and other organizations have sent nurses and an occasional physician to aid. To the observer, who can see behind the scenes, there awaits a vision of medicine at its best: and then only does a small part of the picture come into view.

Vivid impressions of places, people and cases; operating rooms in hotels and hospitals, log cabins and nursing stations, homes and lodging houses; meetings and partings; assembling and taking down of equipment—scenes that remain as sharp and clear as an etching—such is the life of a traveling dental clinician.

The first day it is the boarding house in an Icelandic settlement. The big room has been cleared and given a wholly unnecessary recleaning and is now the operating room. The children come to school in horse drawn vans so the operator has them literally by loads at a time. The house swarms with them.

The first patient: a swift examination a question or two, a slow injection of anesthetic (this is the first experience of dentistry for many of these children and extra care must be taken not to startle them), a brief dismissal, and the next one. A cavity is cut and the filling placed, an injection made for the hopeless tooth. Time now to extract for the first one. A few words of explanation and encouragement, a few seconds' swift work and then, "Hurt"? "No." "Fine." A pat on the back and a satisfied child is away to show the place where an old offender has been and to explain his feelings, in detail, to admiring mates.

Humor is not wanting to lighten the day as in the case of the 5-year-old young lady who swallowed a taste of procain. On being tested with a probe and asked if her gums hurt, she answered swiftly and shrilly: "No! but my belly does."

Then there was the boy who turned up day after day for the removal of yet another baby tooth (any one of which could have been self-extracted), and went away smiling. The mystery was cleared up when his mother informed the operator that the visits had cost her a

dollar and a half. The bold laddie had been promised a quarter to visit the dentist, and being a good business man, had figured the more visits, the more quarters.

The last day comes and one is surprised at the mounting lists of record charts. Yet the time seems so short when there is so much more that could be done. A schedule is a stern master, and the next place is waiting, so the last cup of four o'clock coffee is interrupted to extract a last tooth; to give a final examination to the fisherman, who had traveled many miles over the frozen lake, where his nets are set through the ice to provide food for the tables of Chicago and New York, and who had given up an impacted lower third molar with the aid of a flickering lantern, an elevator and a lot of good luck, and a start is made.

Farewells are said while the train is held to load the delayed equipment. It is a friendly train, this, and although it is largely fish-filled box cars and runs only twice a week, it has something the main line express lacks—a human touch, an atmosphere of service and helpfulness.

Dinner time and the end of steel. One is quite a veteran now at picking out the waiting committee and, in a few minutes, has been installed, in comfort, in the log hotel that is to be the home and office for the next week. Six months is the age of this town, and yet all arrangements have been made by a public spirited group of citizens and everything is ready.

Days of work; work that is made deeper and more interesting by the generous cooperation of mothers who have left their household duties to be a dental assistant for a day. What wonderful assistants they were and what a knowledge of child psychology they displayed! One among them had, for many years, worked side by side with her doctor husband on hospital work in the deary wastes of Siberia; only to see him die in a dungeon; and after almost unbelievable adventures. With her young sons, she found freedom in Canada from the perils of revolution-swept Russia. Graduate of three universities and a trained nurse, she gave invaluable aid. As the operator spoke no Russian, German or Flemish, when English became hopeless a conversation was carried on in Latin that would have caused a college professor to collapse.

Here, too, word was carried to the district nurse, and after traveling many wearly miles through the woods, she came to help on an ether case. Ether was found, but the mask was missing. A soup strainer pressed into action succeeded in half anesthetizing both nurse and operator, and leaving the patient almost untouched. After recovery, a local anesthetic had to be resorted to.

Evenings of relaxation in hospitable homes where one may be at ease and friendly and happy. Attending a brilliant lecture by the school supervisor, in the little log school house, a teacher whose schools were scattered over hundreds of miles of territory, and whose health and more pressing desire to serve had led him to remove from the city to direct his scattered, efficient staff. So contented an existence that it is a wrench to leave and one does so only with an inward promise to return again.

A cold winter morning, and the same mixed train has deposited dentist and equipment at yet another town. Here, the station is half a mile from the town for the better convenience of the winter fishers who drive in from the ice covered lake in their sleds. Queer contraptions these, with their canvas tent on top, inside which the driver sits on his load of boxes in front of the glowing wood-burn-

ing stove, whose stovepipe, sticking through the canvas roof, waves a plume of grey smoke. It gets cold in this country, and these people have learned the fine art of winter travel.

Transportation is waiting, and the separation of town and station is soon driven over. Here, an office is set up in the kitchen of a newly built women's institute and nursing service cottage. Not many days here, because there has just been an ending to an outbreak of measles; the schools are not yet open, and it is consequently hard to get news around. By 10 o'clock, the chair is up and the day is started. Children are already waiting, and more are on the way who have started before dawn in the family cutters with little houses built on them, each with its little warming stove, to keep out the bitter cold.

In the afternoon, the nurse who rules this district drives back after an all night case and relieves the housewife who has been the dentist's right hand. Protests are of no avail, even though the nurse has been, for days and nights, traveling and attending cases. On this last one, she has just come from nursing an entire family, and this very morning attended to the burial of the youngest. There is work to be done, and even though there is a tired body and a sad mind, she carries on, with a smile, until the day is done.

Evenings spent in the dispensary where the thin walls mock the huge log burning stove and where it is sometimes 40 below zero in the opposite corner when the fire burns low. One must wear overshoes indoors to keep the body heat in.

Talk of travels and books and cases; of far cities and contrasting experiences in them; and to the dentist, a deepening of the admiration and respect for these pioneer alleviators of human suffering, a deepening of the longing to know the whole story (so zealously hidden) of what these people do and a strengthening of the wish that the outsider come to see and help.

A long ride this time; graduating to a sleeping car that joggles on steel too light for it. An early morning change to yet another mixed train, and continued slumber on a short backed seat. Wakened by a question as to whether I am the dentist, and a hurried rush from a moving train to find the equipment will not be along until later. A missed connection somewhere.

Here we have a hospital and, be it confessed, it is with considerable trepidation that we enter. Can we live up to it after our travels? What groundless fears! This is home.

Another service station for humanity, striving desperately to stem the tide of suffering. Not a soulless mechanism of a city institution, but a live, human, Christian society, the sort of place, one reverently imagines, where He would have liked to work His miracles and rest.

A place of hope, the center of community life and a leaven working in the tremendous mass of foreign born surrounding it. The lone physician, a Persian who, after many years of untiring missionary work in Persia and a private practice comprising the nobility, has returned to the country of his student days to carry on in this new field. Nurses, graduates of famous hospitals, postgraduates of such places as New York's famous child clinics, yet willing and able to paint, in their few spare hours, the three story hospital when the missionary society funds are low.

A place where children came in hundreds, walking miles through blinding snow, by team, by train, in groups shepherded by relatives, teachers and outpost workers, and singly. Some suffering for

months with conditions that only a dentist could relieve; came so thick and fast that extra time on the return was asked for and granted. Literally hundreds of them seeking relief and hurrying away to find a little sister or brother so they, too, might share in the relief from pain.

That first day: Working with the forceps which had fortunately been packed in the traveling bag, using a morphin syringe; emptying the carpules into it and leaving the needle behind after every injection withdrawal (fortunately, a new supply of anesthetic had been expressed ahead); using one's lap as a head rest. What a relief when the equipment turned up.

Cases? Six year olds with abscesses draining through the neck. Thanks be for the resident physician and his ether bottle. Chewing on nerves that had suffered so long they had grown out of the tooth and covered themselves with a tissue coat to withstand the shock of mastication. Teeth twisted and turned; double sets decayed; teeth causing stuttering and appearing in almost all places in the mouth—all stages of decay—teeth at their worst.

Halls and rooms so full of children, they overflow into the yard. And with it all, a staff who, busy with their medical service, assisted, helped and encouraged so that twice the daily quota was gone through. Truly, it was a revelation of what a missionary hospital can be and do.

At the next stop, the clinician found the public health nurse, who was the advance guard and whose untiring efforts had resulted in flawless arrangements and the saving of much valuable time. Midnight, and the Pas train halts, briefly, at the little town, once the center of the lumber camps, and one is deposited, boxes and all, in front of the station that bears a startling resemblance to a box car.

Here, our committee of the nurse and the school teacher and his wife awaits. An extra size toboggan is ready and the kit piled on it. Many were the laughs we had later (the teacher and I) of that pull through the snow in the pitch dark. He claims that one of us was going north, the other south, inside the 2 inch rope. We did spend much of the time off the trail in snow almost waist deep, so he may go uncontradicted, even if he is an old army mate. The fact remains, though, we did get there too breathless to argue.

This time a log cabin to work in, with a bedroom for a waiting room—and then they came. Whole schools at a time, with the teachers as escorts. Schools from 50 miles away, even to the Indians from Old Fort. How the days did go until, at 8, the chair was relegated to a corner to make room for a bridge table. Not always to stay there, however, for this is a country of distances, and it takes time to travel even if one does start early in the morning.

More pitiful cases, two of which were taken to the hospital, on the way down, for better facility in operating. More cooperation and once more the evidence of cultured, intelligent people giving themselves and their lives to a community. A London graduate in music teaching where the only instrument is the battered church organ.

A short stop at the hospital again. More cases, with a morning of ether work that well filled one side of a bed ward. Then away to the end of steel on another line. The final post.

This time a Red Cross station. Arriving after 8, we find the escort waiting, and, in a short time, are comfortably settled. Train night is an event at the

end of the steel, and so, many people are in from the surrounding country. Incidentally, that means more patients at the station and, for the first few hours, the nurse is busy compounding, advising and generally carrying on all the essentials of a medical practice. When things have quieted down, the proverbial teapot appears, and we have a chance to become acquainted.

That night the chair is set up and everything arranged for an early start, because the train has been picking up children all along the line on the way in, and the dentist has already met several of his young paitents.

Ready to start in the morning, it is discovered the nurse has been away all night on a case and has arranged for everything. So we start in, and when she arrives at noon, we have something to show for a morning's efforts.

And so it goes. Days when we handle thirty and more and average well over forty teeth a day in extraction (unfortunately, most of them first permanent molars), besides the other work, so that it is often after 8 before the housekeeper can (after repeated hints) get us to the table.

Here, too, came some minor surgery, and the rubber gloves and the sterile field made their appearance. Doubly glad were we for the able assistance of a trained, experienced postgraduate surgical nurse.

And Saturday night: Two ether cases on the dining room table and the generous assistance of the mother next door. Nothing strange to this table: the traveling Red Cross physician has performed major operations on it. Later, when the little patients are chattering again and away to bed, a game of cards on the same table. Such are the contrasts of life.

Sunday and ready to go out to dinner. Ruthenian parents with a little tot of 5 to see the nurse. History of vomiting blood and "feel no good." A thorough examination reveals a constant drip, drip from swollen gums around infected teeth, and a pitiful case of adenitis with the glands broken down and suppurating. Scarred for life. Again the ether bottle appears, and after much patient allaying of superstitious fears, the parents hover fearfully around while the case is cleared up. Soon the little one is explaining, in a foreign tongue, all her sensations to her relieved parents.

Not the least interesting part of the stay here was the occasional ride out with the nurse on her night calls. Long will such a call be remembered and the coming back through the cold night. Then the usual happened, and we came home on the rim with the dentist part time balanced on the running board to keep the old Ford on the high crowned road (?) and out of the ditch. What a welcome the roaring stove at that 5 a. m. journey's end.

And this little red-headed Scotch girl has worked alone, many miles from any doctor: traveling for months with a dog team, stamping out an epidemic among the Indians; taking surgical cases down the line on a hand car to the nearest hospital; working on maternity cases; using the left hand for the ether cone and striving desperately to keep the right sterile; and never, no matter the complication, losing a case.

A fitting climax to the trip was the last ride through a fair imitation of a blizzard: crashing through the rotten ice of swamps; often lost, but finding the trail again through the wood's skill of the driver. Forty odd miles of it, with a hospital emergency case of the nurses, to catch the Main Line Train to Winni-

peg. After 2, and just there with two minutes to spare.

For sheer helpfulness, recommend a train crew. How they helped: moving the train to just the right spot for a quick transfer of the sweet wee one; carrying hot water bottles and assisting so thoroughly and well that not a precious second was lost.

So the trip has ended, and, to the operator at least, it has brought a widening of vision and a newer incentive to work and study, and left a treasure house of delightful memories.

The spirit of these pioneers may best be exemplified by the case of the grandfather, skilled woodsman for many years, who is returning from the hospital to the homestead to see for the first time his children and grandchildren. And who is wondering, too, if he can swing the axe as skilfully, with the sight of the one good eye the operation has given him, as when he was blind.

The story of those who, with untiring zeal and self sacrifice, conscientiously and quietly, day and night, year in and year out, give themselves and their training to the great battle to relieve and prevent human suffering in the far places—that story will never be told, because they are a modest band who work in the name of the Great Healer and their work is their justification and their life.

It were impertinence for the writer of this fragmentary article to try and do them justice, for truly they are of those whose "deeds shall be sung by silver trumpets."

## A PROPOSED MOVIE FILM LIBRARY

By GEORGE H. WANDEL,* D.D.S., Chicago, Ill.

TO the individual who has attended various district, state and national dental meetings in recent months, there is apparent an ever increasing production of films showing various phases of dental technic. The Sixty-Sixth Meeting and Clinic of the Chicago Dental Society threw an interesting light on the growing extent to which the motion picture has been adopted by some of the most advanced workers in all branches of the dental profession. Only a year ago, the technical dental movie was championed by just a tiny handful of pioneers. This year, at the Chicago meeting, no less than ten reports were illustrated with 16 mm. motion pictures. Almost every scientific section was represented on the clinical movie roster. Besides, several dentists who were not listed as clinicians or essayists brought along films of their own making and arranged impromptu showings.

Among the films which were shown were, "Physiology of Mastication," by Hugh W. MacMillan, and "Pontic and Fixed Bridgework," by Donald E. Smith. A painstaking piece of work was demonstrated by W. H. Wasson. The films of John A. Marshall, W. A. Grouws, C. J. Stansbery, F. E. Roach and J. A. Heidbrink all made indispensable contri-

*Supervisor of the Bureau of Dental Health Education.

butions to the interest and clarity of their papers. The films brought in by F. H. Hall, of Nashville, Tenn. ("Porcelain Jacket Technic") and J. V. Gentilly, of Cleveland, Ohio ("Uses of Gelatin in Impression Taking"), though not a part of the official program, were of high merit and would have offered valuable contributions to the discussion of these subjects.

It has been stated by one well versed in movie requirements that many of the "home made" films shown at the Chicago convention came up to high professional requirements, and that motion picture professionals would do well to recognize these films as at least "quasiprofessional," even according to their own standards. He further stated that this does not mean that there is not room for improvement in these films, because there is room for betterment of the best professional film ever made. Many of the men who are now beginning to write their professional records on celluloid admit that they have much to learn from the movie technician in matters of photography, focus, lighting, composition, tilting, continuity, animation and the like. They further state that while there is no "mystery" to movie making (provided their 16 mm. equipment is really built to the highest professional standards), they have found the movie manufacturers ready to assist them in any way possible to bring about satisfactory results. This is true: the progressive manufacturer is keenly alert to the possibilities offered through stimulation to the production of dental and research films, and if it appears that certain changes and adaptations of present-day motion picture equipment are necessary, the dentist will find that such a manufacturer of movie equipment will meet him more than half way.

The Bureau of Dental Health Education has been watching with keen interest this ever-increasing use of the 16 mm. movie film in the various phases of dental education. The films above mentioned are not the only films of this type which have been developed. Others have recently been brought to light, and, undoubtedly, there are some in existence with which the Bureau is not familiar. It is also known that one of the larger film concerns is now developing dental educational material on 16 mm. film for use in public schools, and several of the dental colleges are rapidly developing film teaching material for use in the class rooms.

The motion picture film can make important contributions to the advancement of the dental profession. Any question of technic, whether universally accepted or furiously disputed, may be presented clearly, comprehensively and dispassionately. The results of minute research in histology, pathology, physiology, anatomy, and in the field of surgery can and are being visualized on the screen. There seems to be no limit to the possibilities in this field. The great Canti cancer film is an evidence of what may be expected along all lines of dental activity.

This is all very interesting and enlightening, and the members of the profession are not unaware of the opportunities afforded them through this channel for study and for professional advancement. This has been evidenced by letters of inquiry which have been received from societies and study groups in different sections of the country, asking about available films on various dental subjects. Even far-off India was heard from the other day.

The Bureau of Dental Health Education of the American Dental Associa-

tion does not feel that it should stand idly by while there exist such great possibilities for development and service in this line of endeavor. The Bureau wishes to encourage those who are blazing the trail in this new field to put forth greater effort to develop more and better films. It is hoped to bring about a universal use and distribution of those films. The dentists in the points distant from the larger cities with their study clubs are handicapped through lack of facilities and finances to carry on the lines of study that they would like to pursue. Even if they could afford to obtain the services of some high class clinician, it works a hardship on the clinician himself to have to travel long distances and neglect his practice over a period of several days in order to keep such engagements. The availability of a comprehensive library of dental films, at a small rental fee per film, would most certainly encourage the development of study groups and "get-together meetings" among the members of the profession in these more or less out of the way localities. Nor would the use of such films be limited to such groups; a number of the inquiries above mentioned have come from societies and study groups located in some of our larger cities.

Of course, it will take time and effort to develop such a film library. The plans for its development are only in the formative stage. But there has to be a beginning to every endeavor, and in order that a start may be made, it is requested that dental schools and individual members of the profession who have reels edited and titled suitable for society purposes will correspond with the Bureau concerning their films. Individuals sending information regarding such films should give a brief résumé of what the film is supposed to show, its complete title, name of the producer, length in feet and number of reels. It is also desired that any suggestions as to how this library can be organized on an efficient basis also be included in the correspondence. Address all correspondence to the Bureau of Dental Health Education, American Dental Association, 58 E. Washington St., Chicago.

**The author desires to give credit to Dr. Hugh W. MacMillan of Cincinnati, Ohio, and Mr. William F. Kruse of Chicago, Ill., for much of the information contained in the foregoing article.**

# CURRENT LITERATURE

## EXTRACTS AND ABSTRACTS

*Electrothermic Surgery in Carcinoma of the Lip:* According to J. Thompson Stevens (*Am. J. Surg.,* December, 1929), the demand for electrothermic surgery, variously designated as surgical diathermy, fulgeration, surgical thermopenetration, desiccation, endothermy, endothermy knife and radio knife, has increased rapidly within the past six years, the reasons therefore being (1) the fact that treatment does not require that the patient give up his occupation; (2) cosmetic results are much better than in other surgical procedure, and (3) ultimate results are better. The author quotes Howard A. Kelly as follows: "I call it the new surgery; it is the biggest thing that has come into the surgical realm for many a year. We are using it every day and it is invaluable in some cases, either where radium fails or where the use of radium has so far altered the tissues that it is impossible to go ahead with it. One beauty of this form of treatment is that it can be so sharply and definitely localized, can be used repeatedly in the same area, and that the wounds consequently are generally not at all painful and healing is so beautiful." Preoperative and postoperative irradiation either with roentgen rays, radium or both is given almost without exception. The objection sometimes offered by surgeons that preoperative irradiation delays healing is obviated by operation within a short time after irradiation, i. e., forty-eight hours. As compared with ordinary excision, electrothermic surgery has the advantage of destroying the malignant growth before it is removed. This plus the fact that the lymph and blood vessels are closed, tends to overcome the danger of mechanical metastasis. In a further effort to avoid this danger, local anesthesia is not used. The operation, which is completed in one sitting, is painful, and it is the author's custom to administer gas-oxygen. Localized lesions which do not deeply involve the lip show 80 per cent recoveries for five years or longer; deep involvement without metastasis, 40 per cent; primary lesions of the lip with metastasis to the neck, 11 per cent. Surprising palliation has been afforded in primary lesions of the lip with metastasis to neck and chest, induration of submental structures and cachexia, but no five-year recoveries are recorded.

*Responsibility of Dentist in Oral Cancer:* The fact that the medical man frequently does not include the mouth in a physical examination places the responsibility for the early detection of oral lesions largely on the dentist (Francis P. McCarthy, in *New England J. Med.,* Dec. 12, 1929). The author suggests that the dentist become an expert diagnostician of all mouth conditions for his own advancement as well as for the welfare of his patients. Cancer usually occurs in men between the ages of 40 and 60, and 75 per cent of lesions are found in constant smokers, whose mouths usually show evidences of bad oral hygiene. This type of patient is also prone to neglect consulting the physicians and so the malignancy may be developed beyond hope of cure. Syphilis and local irritation, as from sharp teeth and ill-fitting dentures, are other etiologic factors. As a result of smoking, women, who have hitherto been practically free from this condition, are being seen with leukoplakia areas, so often the forerunners of malignancy.

*Tumors of Mouth and Jaws:* V. H. Kazanjian (*New England J. Med.,* Dec. 12, 1929) believes that while chronic irritation cannot cause cancer, avoidance of irritation will diminish the number of cases. The dentist must, because of his responsibility as the man whose opportunity it is to examine the mouth frequently, learn to note all pathologic conditions affecting the soft tissues, conditions of palate, throat, tonsils and tongue. Among the benign growths of the mouth are dental cysts. Their danger lies in the fact that they may grow large enough to destroy part of the jaw or to cause fracture. Some malignant

growths may be mistaken for dental cysts. Biopsy will determine their nature. Simple cyst and multilocular cyst must also be differentiated. In the latter, if recognized early, excision, including the outer section of the bone, is sufficient. Later, more of the bone must be sacrificed. Osteomyelitis is sometimes mistakenly diagnosed as cyst. The epulis, a nonmalignant growth, may become irritated and so develop into a malignant lesion. It then becomes necessary to remove the periosteum or part of the bone, to insure a cure. Angiomas are harmless unless they cause hemorrhage. If extensive, they may cause deformity. Fibromas and papillomas are harmless lesions. The former may arise from ill-fitting plates. Hard tumors are sometimes nonmalignant, as extoses and tuberosities. They sometimes cause the prosthetist inconvenience. They are to be removed only if causing inconvenience, or annoyance to the patient. Leukoplakia patches are characterized as precancerous and so must be eliminated. Microscopic examination is sometimes necessary to differentiate leukoplakia from lichen planus or thrush. Sometimes, abstention from smoking will result in disappearance of leukoplakia. Surgery, irradiation or diathermy is necessary if the tissues are hard. Diathermy is the author's preference, as it is simple and usually affords a permanent cure. Radium gives uncertain results. Oral hygiene that includes elimination of all sources of local irritation in the mouth will aid in preventing cancer. Any tissue varying from the normal in texture, color or base should be given further investigation. Tissue that bleeds easily and borders that are elevated or indurated are suspicious. Superficial lesions may slough and leave elevated or depressed borders. The age of the patient, time of onset and duration of lesion and a tendency to progress or regress are important items in diagnosis and treatment. The Wassermann test should be made, and smears should be taken in suspected Vincent's infection. Biopsy determines the final diagnosis. The specimen is obtained by use of the endothermy knife, which forms a wall of coagulated tissue and so eliminates any danger of spreading malignancy to the blood stream.

*Irradiation in Treatment of Cancer:* Cancer of the lower lip has a tendency, according to Henry K. Pancoast (*New England J. Med.*, Jan. 16, 1930), to early and dangerous metastasis and is often highly malignant. Treatment by the radiologist must be most thorough to be effective. If superficial, the primary lesion and surrounding area receive a heavy dose of moderately filtered radium irradiation. If there is induration, the entire area is removed by electrodesiccation. The lymphatic drainage area from the primary lesion to the margin of the jaw subsequently receives a full erythema dose of roentgen rays, which is repeated once or twice. The lymphatic gland areas of the neck receive similar treatment whether the glands are palpable or not. Glandular metastasis has been seen eight years after treatment of the primary lesion only. For five or six years, the case is regularly checked up for signs of recurrence, and the patient is instructed to report at once if any symptoms arise. Mouth cancer offers one of the greatest fields for irradiation, with or without electrodesiccation or surgery. Almost every cancer patient has bad teeth, poorly fitting plates or pyorrhea. Syphilitic scars may be the basis for malignant lesions. The use of tobacco causes many cancers, either directly or through production or leukoplakia. Cancers of the mucous membrane are difficult to eradicate surgically but are admirably adapted to direct radium irradiation. In advanced cases, electrodesiccation is used in addition. Cancer of the tongue is attended by early lymphatic permeation and glandular metastasis. Primary lesions, if small, can be treated by radium locally, and by electrodesiccation or radium implantation later, if necessary, followed by deep roentgen ray or heavily filtered gamma irradiation only. Heavily filtered radium locally is advisable in addition. All mouth cases require great care as to cleanliness. In maxillary sinus cases, the initial treatment is external deep roentgen rays or heavily filtered gamma rays. Many cancers of the alveolar process have their origin in the maxillary sinus and many that are primary in the mouth quickly invade the antrum.

*Carcinoma of Mouth and Lip:* Etiologic factors in these conditions are given by George A. Leland (*New England J. Med.*, Dec. 12, 1929) as: chronic irritation, use of tobacco and syphilis. Of the two types, the hard, indurated ulcerated lesion and the softer, though firm, papillary growth, the former is more malignant and grows more rapidly. These cancers metastasize much more rapidly than uterine, breast or intestinal lesions.

The tumor which may be the forerunner of cancer can be easily eliminated by a simple local operation. The buccal mucosa heals readily even if the lesion has progressed to ulceration. Simple ulcers should be given prompt attention. Treatment of buccal cancer can be divided into (1) local treatment, and (2) treatment of regional lymph nodes. Local treatment, which must completely destroy the growth, may be excision, cauterization or irradiation, by implantation of seeds or needles. The regional lymph nodes may be irradiated but removal is more promising. Carcinoma of the lip is relatively less malignant and the etiology is practically the same as in buccal cancer. Sometimes, a simple excision of the growth results in cure. Only the more malignant growths metastasize. Microscopic determinations are necessary to establish the degree of malignancy to be dealt with.

*Explosion of Ethylene Resulting in Two Deaths:* Reuben Peterson (*Am. J. Obst. Gynec.*, November, 1929; abstr. *J. A. M. A.*, Dec. 21, 1929) reports the death of a maternity patient and her unborn child, a short time before delivery, as a result of the explosion of ethylene gas which was being administered as an anesthetic. Ethylene 25 per cent and oxygen 75 per cent was used in a McKesson apparatus. The explosion was heard throughout the four-story building and the anesthetist was knocked from her chair.

## Foreign Literature

*Physiology (Kruger, Fortschr. d. Zahnheilk. [Leipsic:Georg Thieme], No. 7, 1929, p. 620):* In the general physiologic textbooks, the impression is quite universally conveyed that the thorough mastication of foods and their consequent proper mixing with saliva is largely of mechanical importance. In dental realms, on the contrary, the impression prevails almost unrestricted that the normal digestion and resorption of foods is tremendously influenced or practically controlled by thorough mastication. Blau, as well as Port and Euler, believes that foods not properly masticated are only partially digested. The latter base their conclusions upon the work of Michel and Oefele. Michel found little or no starch in the feces when the food was properly masticated; but when food was bolted or not properly masticated on account of lack of teeth, much starch could be detected. Oefele arrived at the same conclusions as Michel but has observed that the digestion and resorption not only of starches, but of albumins and fats as well, were governed by proper mastication. He even believes that by examination of the feces, he is able to determine just what teeth are missing, whether bicuspids or molars. Pflüger arrived at some interesting but not absolutely convincing conclusions upon the basis of experiments conducted on dogs with fistulas opening externally from the duodenum. In his final conclusions, he states that foods properly masticated and mixed with saliva are apparently better digested and resorbed than those poorly masticated. Becker performed experiments on human beings before rather poor sets of teeth were extracted; later during the time that the teeth were out, and still later when artificial teeth had been placed. In his tables of results, it appears that digestion and resorption of albuminous foods were most satisfactory during the time the patients were edentulous. Interesting as these experiments are, they are not conclusive enough to determine the importance of thorough mastication in the digestion and resorption of foods.

Emil Mueller, Chicago.

*Errors in Dental Construction (Ludwig Kohler, Fortschr. d. Zahnheilk., No. 11, 1929, p. 1015):* The muscle-trimmed periphery of impressions for dentures, especially the portion of the fold near the tuberosities of the upper teeth, must be reproduced in the models if the suction of the finished denture is to be the same as the suction of the impression. In distal or lingual bites of the upper teeth, the overbite of the lower teeth should be shallow. In order to facilitate speech in these cases, it frequently becomes necessary to set the lower anterior teeth distally from the uppers. This often makes it necessary to omit some lower teeth, either anterior or bicuspid. Faulty dentures commonly result from warpage. This is easily recognized in tilting of the denture. Artificial dentures may drop because the peripheral borders are overextended, or because of inadequate adaptation. This faulty peripheral adaptation is discoverable if the borders are closely observed during tilting of the plate with pressure alternately on opposite sides, bubbling forth of air and saliva usually indicating the defective spot. Faulty tooth setting in relation to the ridge, the opposite jaw and the oppos-

ing teeth contributes much to the failure of otherwise successfully constructed dentures.

EMIL MUELLER, Chicago.

*Forensic Dentistry (Julius Misch, Fortschr. d. Zahnheilk., No. 12, 1929, p. 1103):* In Germany, the law considers it the duty of every operator, when undertaking local anesthesia in the oral cavity, to exercise every precaution to prevent the aspiration of anything loose in the mouth in the event of complication or collapse. The opportunity for aspiration becomes particularly great should it be necessary to place the patient in the horizontal position. Therefore, all removable appliances should be removed and the mouth thoroughly examined for loose fillings, crowns or bridges that might become dislodged during an emergency. In the event of unsuccessful local anesthesia, one should never resort to a general anesthetic to complete an operation. This is particularly true of nitrous oxid. Complications and death have resulted from such procedures. Those who work with roentgen rays should be thoroughly informed about the physical as well as the biologic properties of these rays. Injuries to patients usually result from ignorance or indifference on the part of the operator. In therapeutic work, one must know the difference between the skin tolerance dose and the effective or working dose. The two are by no means identical. Care must also be exercised in exposing the jaws of the young with developing teeth in early stages to roentgen rays, because the tooth germs are easily injured or retarded in their development. The use of so-called suction cups or retainers in full dentures is unnecessary and dangerous. A case was shown in which perforation of the palate was brought about through the persistent use of suction cups. In another case, their use brought on chronic osteomyelitis, which resulted in extensive destruction of the palate and alveolar ridges. Fossum questions the belief of McKay that mottled enamel results from the nature of the drinking water. He contends that infections bring about a general physical disturbance that results in mottling of the enamel.

EMIL MUELLER, Chicago.

*Dental Care in Schools (Hans Joachim Tholuck, Fortschr. d. Zahnheilk., No. 12, 1929, p. 1135):* During approximately a four-year period, from June, 1925, to April, 1929, the number of school clinics in Germany increased from 261 to 974. Of late, particular progress has been made in the direction of decentralization of clinics, which, it appears, is becoming more popular everywhere. It is interesting, in this connection, to note that the oldest school clinic in Europe, at Oslo, Norway, has decentralized. One important objection against decentralization is the increased cost on account of duplication of equipment. This is, in part, overcome in Germany through the introduction of movable auto equipment and automobile clinics. The visiting dentists make only examinations; the actual work is referred to private practitioners. It is being recognized that children of preschool age are very much in need of dental services. Jessen estimates that 84 per cent of the children at the time of entering school have caries of the temporary teeth. About four teeth per child are involved by this time. In contrast to the children of preschool age, only about 50 per cent of the school children are in need of dental service. Interesting observations by Wimmenauer concerning diet and tooth development show that caries frequency was less in children born in the war years, 1914 to 1917. He attributes this to the lessened use of sugar and the substitution of whole wheat flour for white flour.

EMIL MUELLER, Chicago.

*Histologic Control of Different Methods of Cleaning Out Root Canals (Rudolf Ullik, Ztschr. f. Stomatol., Vol. 27, No. 11, 1929):* Histologic investigations have been made to determine how far it is possible to eliminate tissue (residual pulp) from root canals by the usual methods. Special attention has been given to the tissue in the apical ramifications which cannot be reached by instruments but might be dissolved by drugs. Newly extracted teeth of all kinds and from patients of different ages have been used. Reamers and broaches were used to enlarge and clean out the root canals, and, along with these, all kinds of drugs have been employed to obtain information concerning the dissolving power of these drugs on the tissue remaining in the niches and branches of the root canals. In some experiments, root canals filled with a drug have been kept at body temperature in a thermostat. It should be emphasized that these experiments dealt with extracted teeth, which allowed not only greater freedom in the employment of strong drugs than is per-

missible when working in a patient's mouth, but also the mutilation of tooth structure. After treatment, the teeth were fixed in formalin (solution of formaldehyd) and the apical part of each root was sectioned transversely. This method demonstrated that sodium hypochlorite is far superior to all other drugs in dissolving power. The main canals, treated with these drugs, have been well enlarged and cleaned out, although plenty of tissue remains have always been found in the ramifications. Much pulp tissue or débris has been present, especially in those places where there is a ribbon-like communication between the two canals of the same root. In cases in which the apex could not be reached with the instruments because of mechanical obstruction, the terminal ramifications always have been found full of tissue. There was no difference in the dissolving power as far as living or dead pulp tissue was concerned. Among 115 ramifications, only three could be found entirely clean and free from organic substances. Finally, investigations have been made concerning the penetration of Howe's alkaline silver solution in ramifications. It has been found that this solution has unusual penetrative power. A precipitate could be found in almost all ramifications. On the other hand, the use of this drug in the mouth must be considered carefully as it is sometimes likely to cause severe irritation of the periapical tissues.

RUDOLF KRONFELD, Chicago.

*Oligodynamic Power of Silver (Hugo Trebitsch, Ztschr. f. Stomatol., Vol. 27, No. 12, 1929):* Like other metals, silver has the power to interfere with the development of the lower organisms. This property of silver and other metals was discovered in 1881 by Naegeli, who found that when metallic silver and copper were placed in water in a jar the growth of algae that would ordinarily occur in this water was prevented. Miller, in 1889, studied the disinfective power of some tooth filling materials. He put small pieces of different metallic fillings on agar plates which had been infected with bacteria from the mouth and was able to demonstrate that around the pieces of filling no bacteria developed; whereas, on the remaining surface of the plate, an abundant growth took place. By many other investigators, the oligodynamic power of substances, especially that of silver, has been affirmed and studied. This power seems not to be reduced by time. It could be shown that slightly infected drinking water can be sterilized merely by leaving a silver spoon in it for a few days. Even if this water is badly infected, the number of germs will be considerably decreased in the same amount of time. Surgeons use silver powder and silver foil for the treatment of infected wounds, ulcers and burns. The use of silver foil, especially in cases of extensive burns, has proved to be an ideal method of reducing pain, preventing infection and stimulating epithelization. The oligodynamic power of silver can easily be demonstrated by putting a small piece of silver wire on an infected agar plate. An area of uniform width (1 to 3 m.m.) that is entirely free from bacterial growth will be found around the metal body. Gottlieb, Stein and Schwarz have found, in testing the reaction of living tissues to root filling materials, that silver powder gives the best results.[1] Schwarz therefore recommends the use of silver powder as a root filling material. To prevent the technical difficulties that arise when working with a fine powder, Trebitsch recommends the use of soft cones of silver of about the shape of guttapercha cones.

RUDOLF KRONFELD, Chicago.

*The Origin of Follicular Cysts (W. Bauer, Ztschr. f. Stomatol., Vol. 27, No. 12, 1929):* The author gives a description of a case of follicular cyst which had been sectioned together with the jaw. The material was taken from the lower jaw of a child aged 7½, who died of diphtheria. Three years previously, the child fell and injured his mouth. Evidently at this time, the germ of the left lower central incisor had been injured, and an exudate formed between the enamel and the enamel epithelium. In the sections, the cyst was found to fill almost the entire body of the mandible. On the lingual side of the cyst wall, the crown was already formed and projected into the lumen of the cyst. The root was still very short and attached to the tissues of the jaw. The deciduous incisor was still in place. The pulp was dead probably owing to the same trauma that caused the cyst formation. Evidently, the periapical infection of the deciduous tooth later on spread and involved the follicular cyst

1. Current literature, J.A.D.A., 16:1775-1776 (Sept.) 1929.

around the crown of the permanent tooth. The case is important because this is the first time that a follicular cyst has been sectioned and studied together with the jaw and the surrounding tissues; also because the history of previous trauma gives a hint as to the origin of the cyst.

RUDOLF KRONFELD, Chicago.

# MISCELLANY

## BOOK REVIEWS

*Encyclopedia of Dentistry.* Edited by Dr. Alfred Kantorowicz, Professor of Dentistry, Director of the Dental Institute of the University of Bonn (Germany), in collaboration with numerous authorities. Volume I, A-F, with 881 pictures and 1 plate. Published by Johann Ambrosius Barth, Leipsic, and Hermann Meusser, Berlin, 1929.

Many textbooks and handbooks giving a more or less complete outline of the whole field of dentistry have been written, but this is the first time that the material has been arranged in the form of an encyclopedia. Only a man of the experience and knowledge of dentistry of Kantorowicz could initiate and carry through this gigantic work. Cooperation of some of the best men in Germany, Austria and Switzerland was obtained in producing this volume. Names such as Adrion, Euler, Fritsch, Hess, Pichler and Weidenreich, to mention only a few of the sixty collaborators, attest the high standard of the contributions, which are of a practical as well as a scientific nature. A review of the contents reveals that nothing of any importance to the dental student or to the practitioner is omitted. This enormous fund of information, arranged in encyclopedic form, is to cover more than 3,000 pages when completed. The alphabetical arrangement should appeal especially to the practitioner who, too busy to search special textbooks for the desired information, can easily find it here merely by looking up the subject.

Each volume contains an index of the entire work. An abbreviated outline of this index will show how thoroughly the entire field of dentistry has been covered:

Anatomy: Anatomy of the mouth; histology of teeth and surrounding tissues; development; phylogenesis of teeth; anthropology.

Physiology: Physiology, chemistry and biology of the teeth, saliva and oral cavity.

General surgery of the oral cavity: Principles of general surgery; prevention of pain (methods and technic of anesthesia).

Special pathology and surgery of the oral cavity: Malformations; diseases of the soft tissues (lip, gingiva, mucous membrane, periodontal tissues, tongue); diseases of the bone (fractures, inflammatory diseases, tumors); disturbances of motility (diseases of the joints); salivary glands, special oral surgery.

Diseases of the teeth and their therapy: Malformations; diseases of the hard substances of the teeth; therapy of caries (methods of cavity preparation and filling); diseases of the pulp and their therapy; dead pulp and its treatment; diseases of the periodontal membrane; diseases and treatment of deciduous teeth; influence of trauma (fracture and luxation).

Prosthetics: Physical and chemical properties of materials used in dentistry; metallurgy; general prosthetics; full dentures; bridgework; porcelain work; surgical prosthetics.

Orthodontia: General orthodontia (craniology, occlusion, etiology of anomalies, heredity, prophylaxis); special orthodontia (types and therapy of anomalies).

Social pathology and therapy: Organization (social dentistry, school dental clinics, prophylaxis); pathology and therapy (industrial diseases, intoxications, hygiene, disinfection).

Dental sociology: Organization of the profession; dental education (Germany and foreign countries); dental jurisprudence; hygiene of the profession; mercury poisoning.

Allied medical subjects: Pharmacology; bacteriology; internal medicine; dermatology; surgery; neurology and psychiatry; ophthalmology; gynecology; otology and rhinology; roentgenology; therapeutic use of rays; electrotherapy.

Miscellaneous: Bibliography; history of dentistry.

At the present time, only Volume I, containing material under A-F, has appeared. Succeeding volumes (three) are to come out during the next few months. As an example of the wealth of material contained in this work, we find under "A": Abdruck (impression), amalgam, anthropology, articulation, and many others, each item being taken up in ample detail, and with many illustrations. Different opinions are given consideration and a complete bibliography is found at the end of each subject. Under the letter "F," we find: Facialis (facial nerve), focal infection, fracture, fillings and instruments used for fillings. These examples show the convenience of the alphabetical arrangement, by which subjects, otherwise unrelated, may easily be found. The price of the first volume is 80 R.M. or $20. The printing and the reproduction of the pictures are the highest type, as would naturally be expected of these well known publishers.

RUDOLF KRONFELD, Chicago.

*Elementary Histology for Dental Hygienists.* By Charles F. Bödecker, D.D.S., F.A.C.D., Professor of Dental Histology and Embryology at Columbia University Dental School, New York, New York. Illustrated; seventy-one pages. Published by William Albert Broder, New York.

This little book will come as a great aid to dental hygienists in their study of the subject. The first part is devoted to a study of general histology and embryology, while the second part deals exclusively with the teeth and surrounding tissues.

At the end of each chapter, there is a list of questions which will be found very useful in reviewing the topic. The author treats the subject in the briefest possible way consistent with clearness, and the book will be found most attractive even to the general practitioner of dentistry for renewing his acquaintance with the subject in the easiest and most expeditious manner. Dr. Bödecker is so well and favorably known in this field that a mere mention of his name is a sufficient recommendation for his book.

## CORRESPONDENCE

### A SUGGESTION FOR NEXT CHRISTMAS

The Christmas season with its legends and good spirit is perhaps the most hallowed of all the holiday seasons, as well as being almost universally observed. Although we are prompted by a desire to show our kindly feelings and express our love for our friends at this season, some customs have grown a little burdensome and fail in the purpose for which they were intended.

Especially is this true in the matter of exchange of Christmas cards. These have become, year by year, more elaborate and expensive, each sender seeming to try to outdo his friends, until the amount of money expended has become in the aggregate enormous. I think most of us are tired of it and would welcome some method by which we could gracefully drop it.

Here is a plan to reform this once good but now worn out custom. It will turn the money now practically wasted to a most worthy cause: Let us figure the approximate amount we spend on the cards sent to our dental friends and mail the amount next Christmas to the Relief Fund.

I have no definite plan by which this may be done. Here is a suggestion: Let each subscriber to the plan send to the Relief Fund a list of those dental friends to whom he has been sending cards. The Fund will send to each of these names an appropriate inexpensive card, the wording of which can be taken care of in our formulated plans later. The plan would develop somewhat like a chain letter. Each man receiving this card would probably join the "Good Samaritans" the following Christmas and send in his list and check. The committee would not send out the cards until the donor had sent his check. The amount would be determined by each donor. The intention at this time is to include only our dental friends. A plan to include others might possibly be worked out later.

Now let us join hands in unloading a responsibility that has become irksome, and boost a cause dear to the heart of every American dentist.

What do you say?

J. M. PRIME.

## MAY DAY 1930 AND THE PARENTS

May Day—National Child Health Day 1930—strikes a deep and vibrant note. Each successive May Day has challenged us to think and act on one particular thing vital to the health and well-being of childhood, from the correction of their remedial defects to the provision for every child of the right kind

of recreation, in the right amount and the right place.

This year, May Day addresses itself to the fathers and mothers of the United States. On them depends the success of all efforts to ensure a sound mind in a sound body to every child. Therefore, the National Child Health Day Committee of the State and Provincial Health Authorities of North America chose as the special keynote of 1930 "Parent Cooperation in Community Child Health and Protection." They know that the state's official health work will be effective for children in proportion to the intelligent cooperation of the parents of little Johns and Marys and their baby sisters or brothers.

Intelligent rather than blind cooperation is within the ability as well as the desire of fathers and mothers. They want to do everything in their power to have healthy, happy, successful children. The expectant young mother wants to know how to take care of herself so that she will bear a healthy baby. When the baby comes, she wants to know how to keep him healthy and happy. Father, who is less intimately involved in these problems, is equally concerned and equally anxious to do his part.

In parental anxiety to protect the children, there is powerful emotion that impels action but that contains also a certain element of danger. To act on an emotion, whether of love or fear for the child, produces less good results than to act on emotion directed by intelligence.

The time has come when parents ask for something more than ever before. They ask to be drawn more actively into the program, to be better informed on the whole subject of child health, to know what each separate group, working in this field, is doing and how its work fits into the whole. They are ready for a new and clearer interpretation of the community's child health program and their responsibility for it.

Divisions of child hygiene can help enormously to make possible intelligent parent cooperation. They can prepare material that explains what the state child health program is and how it will protect the child in his home. Schools, both directly through their contacts with the parents and indirectly through parent-teacher association study groups, can still further help parents to the understanding for which they are asking. Libraries can make a valuable contribution by getting together simple material which has been recommended by local physicians and to which fathers and mothers can refer. Magazines and newspapers can and do help, by every line which they carry on the well-being of children. If a news item or an article arouses a mother's interest and makes her realize that to be a good mother requires knowledge as well as instinct, it has accomplished much. And if, in addition, the other health forces provide her with the means of acquiring further knowledge, still greater progress is made to that most important of all goals, intelligent cooperation.

These are some of the things of which May Day—National Child Health Day 1930—reminds us. May Day asks of us all—parents and health workers—intelligent cooperation in the nation's child health program. The President can call a White House Conference on Child Health and Protection; others can say "Let us consecrate May Day to the children of the United States." But only parents by their cooperation can make the results of the conference practical in the life of the child, and can translate the ideal of May Day into child health, child happiness and child success.

## NEWS

*Rhode Island Society Officers:* The officers of the Rhode Island State Dental Society for the year 1930 are as follows: president, Frank H. Ackrill; vice president, Phillip A. Duffy; treasurer, Francis I. Canning; editor, Ambrose H. Lynch; secretary, Charles J. Smith.

*Delaware State Society Officers:* The Delaware State Dental Society has elected the following officers for the year 1930: president, Clyde A. Nelson, Milford; vice president, Walter O. Stack, Wilmington; secretary, J. Paul Wintrup, Wilmington; treasurer, Phillip A. Traynor, Wilmington; librarian, William Stewart, Jr., Wilmington.

*John Oppie McCall to Be Director of Guggenheim Dental Clinics:* The Murry and Leonie Guggenheim Dental Clinic, which has completed plans for a large dental clinic for children and a school for dental hygienists at 422-428 East Seventy-Second Street, New York City, and which proposes, on the completion of the central clinic building, to extend its mouth hygiene work for needy school children into other sections of the city, has appointed John Oppie McCall, D.D.S., as

director of the clinic, to take charge on the completion of the Seventy-Second Street building. Dr. McCall was the first chairman of the Oral Hygiene Council of the New York State Dental Society, which conducted an active propaganda for dental surveys in the public schools.

*Resolutions on State Laws Regarding Practice of Orthodontia:* According to the *Bulletin of the Pacific Coast Society of Orthodontists,* January, 1930, the following resolutions were passed at the regular quarterly meeting of the Northern Section of the Pacific Coast Society of Orthodontists, Dec. 10, 1929:

WHEREAS, there has been much discussion of special legislation in the State of California which would provide for the licensing of orthodontists for the practice of their specialty without complying with the requirements of the existing California Dental Law; and

WHEREAS, the Northern Section of the Pacific Coast Society of Orthodontists believes any variation in the state dental act of the creation of any new legislation which aims to set up different standards for the orthodontist, the periodontist, the exodontist, the oral surgeon, the prosthetist or other departments of dentistry to be inimical to the best interests of dentistry, as well as to the public; and

WHEREAS, such orthodontic legislation has already been created in the passing of the Arizona Orthodontia Law; and

WHEREAS, the improving or correcting of faults in the occlusion of the teeth is recognized as a basic principle of dental practice, it is believed this privilege cannot be legally denied any member of the dental profession now or hereafter; therefore, be it

*Resolved,* that the Northern Section of the Pacific Coast Society of Orthodontists hereby records its opposition to any such legislation as that inaugurated in Arizona, or any similar legislation which may be proposed by any person or group in the State of California, and that the secretary be directed to forward a copy of these resolutions to the board of directors of the Pacific Coast Society of Orthodontists for their consideration.

*Section Officers for 1930:* The following are the officers of the scientific sections of the American Dental Association for the 1930 Session: Operative Dentistry, Materia Medica and Therapeutics: chairman, Harry B. McCarthy, Baltimore, Md.; vice chairman, Edouard M. Hall, Kansas City, Mo.; secretary, E. L. Knox, Dallas, Texas; Full Denture Prosthesis: chairman, O. M. Dresen, Milwaukee, Wis.; vice chairman, Ralph L. Christy, Denver, Colo.; secretary, Clyde H. Schuyler, New York City; Partial Denture Prosthesis: chairman, Herman A. Maves, Minneapolis, Minn.; vice chairman, E. L. Knox, Dallas, Texas; secretary, F. F. Whitcomb, Omaha, Nebr.; Oral Surgery, Exodontia and Anesthesia: chairman, Roy S. Hopkinson, Milwaukee, Wis.; vice chairman, Earle H. Thomas, Chicago, Ill.; secretary, E. C. Hume, Louisville, Ky.; Orthodontia: chairman, Abram Hoffman, Chicago, Ill.; vice chairman, Max E. P. Ernst, St. Paul, Minn.; secretary, Ernest N. Bach, Toledo, Ohio; Periodontia: chairman, Isador Hirschfeld, New York City; vice chairman, C. S. Kramer, Woodman, Colo.; secretary, Edward L. Ball, Cincinnati, Ohio; Mouth Hygiene and Preventive Dentistry: chairman, G. H. Wandel, Chicago, Ill.; vice chairman, E. F. Sullivan, Boston, Mass.; secretary, Ernest A. Branch, Raleigh, N. C.; Histology, Physiology, Pathology, Bacteriology and Chemistry (Research): chairman, William Hopkinson, Milwaukee, Wis.; vice chairman, Isador Hirschfeld, New York City; secretary, E. D. Coolidge, Chicago, Ill.

*Dental Brush Wheels:* Manufacturers, distributors and users of dental equipment, meeting in December, 1929, in Chicago, Ill., approved a proposed simplified practice recommendation for dental brush wheels. The one session of the convention of the American Dental Trade Association that was under the auspices of the division of simplified practice recommended that brush wheels bearing the following numbers constitute the simplified list of sizes: Nos. 12, 20, 23, 25, 26, 27, 29, 30, 65 and 66. This program has been in process of development for some time by the simplified practice committee of the American Dental Trade Association. It is one of a series of similar programs in the dental line in the promulgation of which the association has sought the cooperative service of the division. A summary report of the conference and an acceptance blank have been mailed to all interests. Those readers of this magazine who have not received this data but who are desirous of becoming informed may secure information by addressing the Division of Simplified Practice. When signed acceptances

have been received from those who are concerned with at least 80 per cent of the annual output of brush wheels, this recommendation will be printed as a part of the "Elimination of Waste" series of the Department of Commerce.—*Commercial Standards Monthly,* Jan. 15, 1930.

*Physicians and Dentists Join in Model Health Center:* The Lane County Medical Society and the Southern Willamette District Dental Society (Oregon) have jointly established a model educational health center for the public of Lane County and as a centralized business office for the two professions. The center, the offices of which are at 865 Olive Street, Eugene, is a recognition of the feeling of responsibility to make available to the public scientific information on health. The plan includes graduate instruction for physicians and dentists, and education of the public as to the aims of medical and dental science and to an understanding of the rules of healthful living, to teach the public to discriminate between the scientific methods of the trained physician and dentist and the unscientific methods and nostrums of the charlatan. The institution will carry on those business activities for physicians and dentists which can best be done by their societies. The centralized plan was developed with the assistance of Mr. Clyde C. Foley, executive secretary of the Oregon State Medical Society. In some cities and states, the activities that will be centralized here are carried on through several independent and sometimes overlapping organizations. The center in Eugene will have a free public health information bureau and reading room where laymen may come to read health books, pamphlets, magazines and posters, some of which will be available for them to take to their homes. The public will be able to obtain biographic details about physicians and dentists and lists of members of the medical and dental societies in order that they may better be protected against unscrupulous and unqualified practitioners. The center will assist school teachers in planning health instruction and in supplying material for health studies in the school; clubs, churches and other groups may call for similar assistance. The business service to be conducted for the two professions will include a credit bureau which will maintain a clearing house of credit information, an employment registry for nurses and technicians and information about where physicians and dentists may go for graduate study. There will be here also a department which will handle medical and health books, stationery, and scientific journals and various printed forms used in the offices of these two professions. The new health center will be the headquarters of the Lane County Medical Society and the Southern Willamette District Dental Society, the officers of which actively engaged in its organization. It will be under the direction of physicians and dentists and under the general supervision of the executive secretary of the Oregon State Medical Society. Mr. Clarence L. Fitzwater, long a resident of the county, will be field representative. Maud Van Carmen will be in charge of the office, and the public health information and the reading room will be under the direction of Mrs. David T. Bauman, a recent graduate of the state university.—*J.A.M.A.,* Jan. 25, 1930.

## Deaths

*Beckstine, Darrell O.,* Bloomington, Ill.; Chicago College of Dental Surgery, 1926; died, December 6. The widow and a son and a daughter survive.

*Burris, Charles Jacob,* Washington, Ind.; Indiana University School of Dentistry, 1907; died, November 8; aged 49. Dr. Burris saw service with the American Army in China, in the Boxer Rebellion, and later spent three years in the service in the Philippines. He was for four years a member of the Indiana State Board of Dental Examiners (1923-1927).

*Crofwell, James B.,* Boston and Roxbury, Mass.; Harvard University Dental School, 1899; died, December 18.

*Genter, James H.,* Chicago, Ill.; Northwestern University Dental School, 1912; died recently of heart disease; aged 43.

*Scanland, Robert Morris,* Peoria, Ill.; died recently, of heart disease, following an operation.

*Smith, Charles E.,* Chicago, Ill.; Chicago College of Dental Surgery, 1908; died, January 12; aged 47.

*Tanner, Arthur,* Chicago, Ill.; Northwestern University Dental School, 1919; died, December 10.

# ANNOUNCEMENTS*

## CALENDAR OF MEETINGS

American Dental Association, Denver, Colo., July 21-25.

American Academy of Periodontology, Colorado Springs, Colo., July 17-19.

American Board of Orthodontia, Nashville, Tenn., April 7.

American Dental Assistants Association, Denver, Colo., July 21-25.

American Dental Hygienists Association, Denver, Colo., July 21-25.

American Dental Society of Europe, Nice, France, April 21.

American Full Denture Society, Denver, Colo., July 18-19.

American Society of Oral Surgeons and Exodontists, Evergreen, Colo., July 18-19.

American Society of Orthodontists, Nashville, Tenn., April 12-14.

Australian Dental Association, Brisbane, July 7-12.

International Association of Dental Research, Toronto, Canada, March 24-26.

International Dental Federation, Paris, France, August, 1931.

### STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

#### March

Rhode Island (12).

#### April

Alabama, at Montgomery (15-17).
Connecticut, at Stamford (22-24).
Kansas, at Topeka (21-23).
Kentucky, at Louisville (7-9).
Louisiana, at Lake Charles (24-26).
Montana, at Great Falls (3-5).
New Jersey, at Asbury Park (April 30-May 2).
North Dakota, at Bismarck (April 29-May 1).
Oklahoma, at Tulsa (21-24).

#### May

California, at Sacramento (21-24).
Illinois, at Decatur (13-15).
Indiana, at Indianapolis (19-21).
Iowa, at Des Moines (6-8).
Maryland, at Baltimore (5-7).
Massachusetts, at Boston (5-9).
Michigan, at Detroit (5-7).
Missouri, at St. Louis (19-22).
Nebraska, at Lincoln (19-22).
New York, at New York City (12-16).
North Carolina, at Asheville (5-8).
Pennsylvania, at Philadelphia (6-8).
South Carolina, at Columbia (20-22).
South Dakota, at Sioux Falls (12-14).
Tennessee, at Nashville (13-15).
Texas, at Fort Worth (20-23).
Vermont, at Burlington (21-23).
Virginia, at Richmond (12-15).
West Virginia, at Fairmont (19-21).

#### June

Arkansas, at Little Rock (2-4).
Georgia, at Atlanta (11-13).
Maine, at South Poland (19-21).
New Hampshire, at Laconia (4-6).

#### July

Wisconsin, at Milwaukee (9-11).

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Alumni Association, College of Physicians and Surgeons, San Francisco, March 7-8.

Rehwinkel Dental Society, Chillicothe, Ohio, March 22.

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### MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Indiana, at Indianapolis, June 12-16. J. M. Hale, Secretary, Mt. Vernon.

Kentucky, at Louisville, June 11.

Maine, at Augusta, June 30-July 2. Alton H. Swett, Secretary, 192 State St., Portland.

New Jersey, at Trenton, December 1-6. John C. Forsyth, Secretary, 148 W. State St., Trenton.

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*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Texas, at Houston, June 16. Maxwell C. Murphy, Secretary, Temple.

## ARKANSAS STATE DENTAL ASSOCIATION

The Arkansas State Dental Association will meet at the LaFayette Hotel, Little Rock, Monday-Wednesday, June 2-4. All ethical practitioners are invited.

I. M. STERNBERG, *Secretary,*
302 Merchants National Bank Bldg.,
Fort Smith.

## AMERICAN SOCIETY OF ORAL SURGEONS AND EXODONTISTS

The twelfth annual meeting of the American Society of Oral Surgeons and Exodontists will be held, July 18-19, at the Troutdale Hotel, "Troutdale-in-the-Pines," Evergreen, Colo., thirty miles from Denver. It will be necessary to make reservations at the Troutdale Hotel for this meeting and reservations in Denver for the meeting of the American Dental Association.

A. L. FREW, *Secretary,*
4105 Live Oak St.,
Dallas, Texas.

## XI PSI PHI FRATERNITY—BEDOUINS OF ZETA CHAPTER

The annual meeting, with reunion and banquet, will be held, Saturday, March 15, at the Chalfonte-Haddon Hall, Atlantic City, N. J.

HOWARD H. SHEPLER, *Secretary,*
Medical Arts Bldg.,
Philadelphia, Pa.
W. C. T. BAUERLE, *Chairman.*

## ST. LOUIS STUDY CLUB

The St. Louis Study Club of Dentistry, founded in 1919, for the purpose of teaching advanced dental subjects to ethical dentists without charge, will observe the completion of its twelfth annual term with a clinic and dinner at the Hotel Chase, Kingshighway and Lindell Blvd., Wednesday, April 2. The clinic, which will start promptly at 3 o'clock, will present the following subjects: dental ceramics; oral prophylaxis; fixed bridge technic; rizadontia (root canal technic); anatomy and dissection of the head; tooth form and cavity preparation; dental roentgenology; full dentures; dental economics; conduction and local anesthesia; crown and inlay casting technic; oral diagnosis and diseases of the mouth; ultraviolet light and its application to dentistry. A dinner will be given at 6:30. Ethical members of the profession are invited to attend both the clinic and the dinner. Bulletins descriptive of the study club can be had by addressing

FRANK C. RODGERS,
903 Missouri Theater Bldg.,
St. Louis.

## LOUISIANA STATE DENTAL SOCIETY

(Change of Dates)

Notice has been given of change of dates of the Louisiana State Dental Society from April 3-5 to April 24-26, at Lake Charles.

W. J. HEALEY, *Secretary,*
Maison Blanche,
New Orleans.

## AMERICAN ACADEMY OF PERIODONTOLOGY

The seventieth annual meeting of the American Academy of Periodontology will be held at the Antlers Hotel, Colorado Springs, Colo., July 17-19.

CLYDE C. SHERWOOD, *President,*
CLAYTON H. GRACEY, *Sec'y.-Treas.,*
269 Rowena St.,
Detroit, Mich.

## ONTARIO DENTAL ASSOCIATION

The annual convention of the Ontario Dental Association will be held at the Royal York Hotel, Toronto, May 19-22. Ethical dentists of provinces of Canada and from the United States are invited to attend.

FRED J. CONBOY, *Sec'y.-Treas.*
East Block Parliament Bldgs.,
Toronto.

## KANSAS STATE DENTAL ASSOCIATION

The fifty-ninth annual meeting of the Kansas State Dental Association will be held at the Jayhawk Hotel, Topeka, April 21-23. Among the essayists are: Paul A. Barker, Denver, Colo.; Clarence O. Simpson, St. Louis, Mo.; Martin Dewey, New York City,

and Ewell Neil, Nashville, Tenn. All members of the American Dental Association are invited to attend the sessions.

FRED A. RICHMOND, *Secretary*,
305 Federal Reserve Life Bldg.,
Kansas City.

## RHODE ISLAND STATE DENTAL SOCIETY

The regular quarterly meeting of the Rhode Island State Dental Society will be held, March 12, at 8 p. m., at the Rhode Island Medical Library.

CHARLES J. SMITH, *Secretary*,
146 Westminster St.,
Providence.

## MISSOURI STATE DENTAL ASSOCIATION

The 1930 meeting of the Missouri State Dental Association will be held in St. Louis, May 19-22, at the Hotel Jefferson. The entire dental profession is invited.

O. W. BRANDHORST,
Publicity Committee,
4500 Olive St.,
St. Louis.

## TESTIMONIAL DINNER TO DR. DALY

In appreciation of his contribution to the profession during fifty years of practice, there will be a testimonial dinner tendered to James H. Daly at the New University Club, Boston, Mass., Wednesday, March 12.

EDWARD F. SULLIVAN,
*Secretary of Committee*,
520 Beacon St.,
Boston, Mass.

## NEW JERSEY STATE DENTAL SOCIETY

The sixtieth annual meeting of the New Jersey State Dental Society will be held in the Berkeley-Carteret Hotel, Asbury Park, April 30-May 2. The essayists are as follows: F. Blaine Rhobotham, Chicago, Ill., who will speak, April 30, on "Practical Phases of Children's Dentistry"; Edward T. Tinker, Minneapolis, Minn., who will speak, May 1, on "Abutments for Crowns and Bridgework"; and Alfred C. Fones, Bridgeport, Conn., who will speak, May 1, on "The Dental Hygienist." Clinicians and subjects are as follows: Edward T. Tinker, Minneapolis, Minn., bridgework; M. E. Sawtell, Brockton, Mass., dental economics; Paul Simonsen, Philadelphia, Pa., porcelain jacket crowns; Leo A. Walzak, Baltimore, Md., periodontia; W. I. Ogus, Washington, D. C., radiography; F. G. Neurohr, New York City, thimble jacket crowns. Edward C. Stillwell is director of exhibits.

EDWARD L. WHARTON, *President*,
F. K. HEAZELTON, *Secretary*,
223 East Hanover St.,
Trenton.

## INDIANA STATE BOARD OF DENTAL EXAMINERS

The Indiana State Board of Dental Examiners will meet at 8 a. m., June 12, at the State House, Indianapolis, in the House of Representatives room, for the purpose of examining all applicants with proper credentials. Examinations will probably last through the following dates, June 12-16. Applications should be in the hands of the secretary one week before beginning date of the board meeting. For applications, clinical requirements and other information, address

J. M. HALE, *Sec'y-Treas.*,
Mt. Vernon.

## MAINE STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Maine State Board of Dental Examiners will be held in the State House, Augusta, June 30-July 2. For further information, address

ALTON H. SWETT, *Secretary*,
192 State St.,
Portland.

## TEXAS STATE BOARD OF DENTAL EXAMINERS

The next regular meeting of the Texas State Board of Dental Examiners will be held at the Texas Dental College, Houston, beginning promptly at 8 a. m., June 16, for the purpose of examining applicants for the practice of dentistry in Texas. Applications with photograph and fee of $25 must be in the hands of the secretary not later than June 1. For further information and application blanks, apply to

MAXWELL C. MURPHY, *Sec'y-Treas.*,
King's Daughters' Hospital,
Temple.

## MONTANA STATE DENTAL ASSOCIATION

The twenty-seventh annual meeting of the Montana State Dental Association will be held at Great Falls, Montana, April 3-5.

J. E. BUEHLER, *Sec'y-Treas.*,
411 Ford Bldg.,
Great Falls.

## ISAAC KNAPP DISTRICT DENTAL SOCIETY

The annual all day meeting of the Isaac Knapp District Dental Society will be held, March 12, at Fort Wayne, Ind.

D. G. MERTZ,
519 Wayne Pharmacal Bldg.,
Fort Wayne.

## INTERNATIONAL ASSOCIATION OF DENTAL RESEARCH

The next meeting of the International Association of Dental Research will be held in Toronto, Canada, at the Royal York Hotel, March 24-26. This promises to be a most interesting meeting. Growing activity in research, and interest in the work and usefulness of the association, indicate the election at the Toronto meeting of additional members who will form sections in England, Germany, New Haven, Conn., and Washington, D. C.

All who may be interested are cordially invited to attend all of the sessions.

WILLIAM J. GIES, *General Secretary.*

## THE AMERICAN BOARD OF ORTHODONTIA

(Created by the American Society of Orthodontists, July, 1929)

A meeting of the American Board of Orthodontia will be held at the Noel Hotel, Nashville, Tenn., April 7, beginning at 9 a. m. Those orthodontists who desire to qualify for a certificate from the board as outlined in the article entitled, "The American Board of Orthodontia" page 50, January number of the *International Journal of Orthodontia, Oral Surgery and Radiography*, may receive full information and application form from

B. FRANK GRAY, *Secretary*,
209 Post Street,
San Francisco, Calif.

## THE STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY OF NEW JERSEY

The State Board of Registration and Examination in Dentistry of New Jersey will hold its regular examinations at Trenton, commencing December 1, and continuing for five days thereafter. The examination fee is $25; re-examination fee, $10. Practical tests required are: insertion of a gold filling in a cavity of Class 2, 3 or 4 type. The cavity must be of fair size and reasonably difficult to be acceptable, the candidate to furnish his own patient. Taking of impression, bite, selection of teeth, articulation and trial denture will be required, the candidate to furnish his own patient; also practical examination in mouth diagnosis. Attention is invited to the following quotation from the dental law of New Jersey: "Applicant shall present to said board a certificate from the commissioner of education of this state, showing that before entering a dental college he or she had obtained an academic education consisting of a four-year course of study in an approved high school, or the equivalent thereof." In accordance with this law, the secretary will issue application blanks only on presentation of the required certificate from the commissioner of education, State House, Trenton. Application must be filed complete ten days before the date of examinations (November 21).

Address all communications for further particulars to

JOHN C. FORSYTH, *Secretary*,
148 W. State St.,
Trenton.

## UNITED STATES CIVIL SERVICE EXAMINATION

The United States Civil Service Commission announces the following open competitive examination:

### ASSOCIATE DENTIST

Applications for associate dentist must be on file with the Civil Service Commission at Washington, D. C., not later than March 12. The examination is to fill vacancies occurring in positions of dentists and in positions requiring similar qualifications in the Federal classified service throughout the United States. The entrance salary in the Indian Service is $2,000 a year, with traveling ex-

penses and $3.50 a day in lieu of subsistence. In the Veterans' Bureau, the entrance salaries range from $3,200 to $3,700 a year. Higher-salaried positions are filled through promotion. Competitors will be rated on their education, training and experience.

Full information may be obtained from the United States Civil Service Commission at Washington, D. C., or the secretary of the United States Civil Service Board of Examiners at the postoffice or custom house in any city.

## JOINT MEETING OF MEDICAL SOCIETIES OF THE COUNTIES OF KINGS AND QUEENS AND THE SECOND DISTRICT DENTAL SOCIETY OF NEW YORK

Following is the program for the joint meeting of the medical societies of the counties of Kings and Queens and the Second District Dental Society of the State of New York, March 10: 2:30—"Cooperation of Physician and Dentist in the Recognition of Disease," Sterling V. Mead, D.D.S., Washington, D. C., and George M. Dorrance, M.D., Philadelphia, Pa.; discussed by Harold J. Leonard, D.D.S., New York City, and Gerald S. Shibley, M.D., New York City; 4:15—"What Justifies the Physician and the Dentist in Advising Extraction of a Tooth?" Gilman Osgood, M.D., Rockland, Mass., and Elmer S. Best, D.D.S., Minneapolis, Minn.; discussed by Henry S. Dunning M.D., D.D.S., New York City, and Harold A. Kent, D.M.D., Boston, Mass.; 6:30—Dinner; 8:30—"Oral Conditions and General Health," Boyd S. Gardner, D.D.S., Rochester, Minn., and Joel T. Boone, M.D., Washington, D. C.; discussed by Horace M. Davis, D.D.S., Baltimore, Md., and Emanuel Lipman, M.D., New York City.

A cordial invitation is extended to all practitioners of medicine and dentistry to attend the meeting.

WILLIAM MCGILL BURNS,
For the Committee.

## AMERICAN DENTAL ASSISTANTS ASSOCIATION

The sixth annual meeting of the American Dental Assistants Association will be held in Denver, Colo., July 21-25.

RUTH F. ROGERS, *General Secretary*,
Suite 803—223 W. Jackson Blvd.,
Chicago, Ill.

## NEW YORK STATE DENTAL HYGIENISTS' ANNUAL MEETING

The New York State Dental Hygienists Association will hold its tenth annual meeting, May 13-16, at the Hotel Commodore in New York City. An invitation to attend sessions of this meeting is extended to members of the dental profession, dental hygienists and dental assistants. Members of this organization are urged to cooperate by being in attendance. It is hoped that interest in membership may be stimulated among non-member dental hygienists.

Preliminary programs will be mailed to all members about April 15. Further announcements will appear.

BLANCHE A. DOYLE,
*Corresponding Secretary*,
100 West 59th Street,
New York City.

## AMERICAN FULL DENTURE SOCIETY

The American Full Denture Society will hold its annual meeting at the Argonaut Hotel, Denver, Colo., July 18-19.

R. L. CHRISTY, *President*.
820 Majestic Bldg.,
Denver, Colo.

## HARVARD DENTAL ALUMNI ASSOCIATION AND HARVARD ODONTOLOGICAL SOCIETY

A joint meeting of the Harvard Dental Alumni Association and Harvard Odontological Society will be held at the Harvard University Dental School at Longwood Ave., Friday, April 4. Registration will start at 10 a. m. Members of the Harvard Alumni Association, Harvard Odontological Society and those of the profession eligible to membership in the alumni are cordially invited to attend.

EDWARD C. HOEY, *Secretary*.

## ASSOCIATION OF THE DENTAL ALUMNI OF COLUMBIA UNIVERSITY

The Association of the Dental Alumni of Columbia University has made arrangements for its annual dinner and smoker to be held at the Westminster Hotel, Thursday, March 13. Dinner will be served at 7:30 p. m. For additional information, address

HARRY L. KOREN,
417 Fifth Ave.,
New York City.

## SOME RECENT BOOKS*

Available for Circulation from the

## LIBRARY BUREAU

of the

## AMERICAN DENTAL ASSOCIATION

58 E. Washington St., Chicago, Ill.

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|---|---|
| American Pharmaceutical Assn. | Pharmaceutical recipe book. Baltimore, Md., American Pharmaceutical Assn., 1929. |
| Appleton, J. L. T., Jr. | Bacterial infection with special reference to dental practice. Philadelphia, Lea & Febiger, 1925. |
| Appleton, J. L. T., Jr., & Bryant, C. K. | Laboratory guide in bacteriology. Philadelphia, Lea & Febiger, 1928. |
| Barail, L. C. | High-frequency in dentistry. Paris, France, La Verrerie Scientifique, 1927. (Pamphlet.) |
| Bartels, H. A. | Outline of bacteriology. New York, W. A. Broder, 1929. |
| Berger, Adolph | Principles and technic of oral surgery. Brooklyn, Dental Items of Interest Pub. Co., 1927. |
| Berger, Adolph | Principles and technique of the removal of teeth. Brooklyn, Dental Items of Interest Pub. Co., 1929. |
| Bilpodiwala, M. C. | Care of the teeth, or layman's handbook of dentistry. Bombay, India, Author, 1927. |
| Blunt, Katharine, & Cowan, Ruth | Ultraviolet light and vitamin D in nutrition. Chicago, University of Chicago Press, 1930. |
| Bödecker, C. F. | Elementary histology for dental hygienists. New York, W. A. Broder, 1929. |
| Box, H. K. | Treatment of the periodontal pocket. Toronto, University of Toronto Press, 1928. |
| Bregstein, S. J. | Business conduct of an ethical practice. Brooklyn, Dental Items of Interest Pub. Co., 1929. |
| Broderick, F. W. | Dental medicine. St. Louis, Mosby, 1928. |
| Broderick, R. A. | Dental bacteriology. Outlines of dental science. Vol. 2. Edinburgh, Livingstone, 1926. |
| Broomell, I. N., & Fischelis, Philipp | Anatomy and histology of the mouth and teeth. Philadelphia, Blakiston, 1925. |
| Brothers, E. D. | Dental jurisprudence. St. Louis, Mosby, 1928. |
| Brown, A. J. | Dental metallurgy. Outlines of dental science. Vol. 11. New York, Wood, 1928. |
| Brown, W. L. | Endocrines in general medicine. St. Louis, Mosby, 1927. |
| Buckley, J. P. | Modern dental materia medica, pharmacology and therapeutics. Philadelphia, Blakiston, 1926. |
| Bulleid, Arthur | Textbook of bacteriology for dental students. St. Louis, Mosby, 1927. |
| Bunting, R. W. | A text-book of oral pathology for students and practitioners of dentistry. Philadelphia, Lea & Febiger, 1929. |
| Burchard, H. H., & Inglis, O. E. | Textbook of dental pathology and therapeutics for students and practitioners. Philadelphia, Lea & Febiger, 1926. |

*Books may be borrowed by members of the Association for a period of one week after date of receipt; and if not reserved for some one else, the period will be extended on request. A deposit of $2.00 for each volume asked should accompany all requests for books. This will be refunded on return of books.

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| Burkhart, H. J. | Care of the mouth and teeth. (National Health Series.) New York, Funk & Wagnalls, 1928. |
| Buxton, J. L. D. | Dental pathology. Outlines of dental science. Vol. 7. New York, Wood, 1927. |
| Buxton, J. L. D. | Dental surgery. Outlines of dental science. Vol. 8. New York, Wood, 1927. |
| Cahn, L. R. | Basic principles of general and oral pathology. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1929. |
| Cattell, Psyche | Dentition as a measure of maturity. Cambridge, Harvard University Press, 1928. |
| Clapp, G. W. | Life and work of James Leon Williams. New York, Dental Digest, 1925. |
| Clark, C. A. | Dental radiography. Outlines of dental science. Vol. 5. New York, Wood, 1926. |
| Colyer, Stanley | Chronic infection of the jaws: a short radiological and clinical study. New York, Macmillan, 1926. |
| Daukes, S. H. | Medical museum: Modern developments, organization and technical methods based on a new system of visual teaching. London, Wellcome Foundation, Ltd., n.d. |
| Dental Board of the United Kingdom | Four lectures on "general anaesthesia." London, Dental Board of the United Kingdom, 1926. |
| Dental Board of the United Kingdom | Three lectures on "dental alloys." Delivered under the auspices of the Dental Board of the United Kingdom. London, Dental Board of the United Kingdom, 1927. |
| Diamond, M. | Dental anatomy. A graphic presentation of tooth forms with an original technique for their reproduction. New York, Macmillan, 1929. |
| Endleman, Julio | Special dental pathology: a treatise for students and practitioners. St. Louis, Mosby, 1927. |
| Federspiel, M. N. | Harelip and cleft palate. St. Louis, Mosby, 1927. |
| Feldman, M. H. | Manual of exodontia. Philadelphia, Lea & Febiger, 1930. |
| | First International Orthodontic Congress: held at New York City, August 16-20, 1926. St. Louis, Mosby, 1927. |
| Fones, A. C. | Mouth hygiene; a textbook for dental hygienists. Philadelphia, Lea & Febiger, 1927. |
| Fones, A. C. | Preventive dentistry. Philadelphia, Lea & Febiger, 1925. |
| Foote, J. S. | Bone as a measure of development: When and how we acquired our teeth. Chicago, American Dental Association, 1928. |
| Gies, W. J. | Dental education in the United States and Canada. New York, Carnegie Foundation, 1926. |
| Goepp, R. M. | Dental state board questions and answers. Philadelphia, Saunders, 1928. |
| Goslee, H. J. | Principles and practice of crown and bridgework. Brooklyn, Dental Items of Interest Pub. Co., 1926. |
| Greenfield, A. L. | Interpretation of dental radiograms. Rochester, N. Y., Ritter Dental Mfg. Co., 1926. |
| Gregory, W. K. | Our face from fish to man. New York, Putnam, 1929. |
| Guerini, Vincenzo | Life and works of Guiseppangelo Fonzi. Philadelphia, Lea & Febiger, 1925. |
| Gwinn, C. D. | Textbook of exodontia. Philadelphia, Lea & Febiger, 1927. |
| Gysi, Alfred | Special teeth for cross-bite cases. New York, Dentists' Supply Co., 1928. (Pamphlet.) |
| Hackh, I. W. D. | Chemical reactions and their equations. Philadelphia, Blakiston, 1928. |
| Haden, R. L. | Dental infection and systemic disease. Philadelphia, Lea & Febiger, 1928. |

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| Hanau, R. L. | Dental engineering. Buffalo, N. Y., Author, 1926. |
| Hanau, R. L. | Hanau intraoral method vs. Gysi extraoral method. Buffalo, N. Y., Author, 1927. |
| Hartman, L. L. | Teeth and the mouth. New York, Appleton, 1927. |
| Head, Joseph | Everyday mouth hygiene. Philadelphia, Saunders, 1925. |
| Headridge, David, & Gibson, S. K. | Dental anatomy, human and comparative. Outlines of dental science. Vol. 6. New York, Wood, 1928. |
| Herbst, Emil, & Apffelstaedt, Max | Atlas and grundriss der missbildungen der kiefer and zähne. München, J. F. Lehmanns, 1928. |
| Hertzler, E. | Technic of local anesthesia. St. Louis, Mosby, 1925. |
| Hess, Walter, & Zurcher, Ernst | Anatomy of the root-canals of the teeth. New York, Wood, 1925. |
| Hogeboom, F. E. | Practical pedodontia or juvenile operative dentistry and public health dentistry. St. Louis, Mosby, 1927. |
| Hyatt, T. P. | Hygiene of mouth and teeth. Brooklyn, N. Y., Brooklyn Dental Pub. Co., 1929. |
| Jamieson, J. D. H. | Operative dentistry. Outlines of dental science. Vol. 9. New York, Wood, 1927. |
| Jerman, E. C. | Modern x-ray technic. St. Paul, Bruce Pub. Co., 1928. |
| Jordan, M. Evangeline | Operative dentistry for children. Brooklyn, Dental Items of Interest Pub. Co., 1927. |
| Kanner, Leo | Folklore of the teeth. New York, Macmillan, 1928. |
| Kells, C. E. | Dentist's own book, including a complete bookkeeping and recording system. St. Louis, Mosby, 1925. |
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A list of the Package Libraries available for circulation from the Library Bureau of the American Dental Association will be sent, on request, to any member of the Association.

## AMERICAN DENTAL ASSOCIATION

Denver, Colorado. July 21-25, 1930.

### HOTEL RESERVATIONS

In securing hotel reservations for the 1930 Session, consult the hotel rate-sheet and fill out the blank application below. Mail immediately to the hotel you wish to patronize. The hotel will then advise you of the reservation which they have made for you.

Kindly indicate second and third choices.

Please remember that reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, please write or wire the hotel releasing it.

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### MAIL THIS APPLICATION DIRECT TO THE HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, DENVER, COLO., JULY 21-25, 1930.

.....Hotel. .....1930

Please reserve sleeping room accommodations noted below:

.....Room(s) with bath for.....people. Rate desired $..... (per day)

.....Room(s) without bath for.....people. Rate desired $..... (per day)

Second choice: .....

Third choice: .....

| ROOMS TO BE OCCUPIED BY: | ADDRESS IN FULL |
|---|---|
| ..... | ..... |
| ..... | ..... |
| ..... | ..... |

Please confirm this reservation to applicant. I further agree to notify the hotel at once in the event I am unable to use this reservation.

IMPORTANT TO HOTEL MANAGER: In the event you cannot accept this reservation, please forward this application at once to Dr. I. R. Bertram, Chairman Halls and Hotels, 1222 Republic Bldg., Denver, Colorado, who will attend to its assignment.

| HOTEL | Rooms | Single with Bath | Double with Bath | Single without Bath | Double without Bath |
|---|---|---|---|---|---|
| ADAMS<br>18th & Welton | 115 | $3.00-5.00 | $4.00-6.00 | $2.00-2.50 | $3.00-4.00 |
| AMBASSADOR<br>1728 California | 92 | 2.00 | 2.50 | 1.50 | 2.00 |
| ALBANY<br>17th & Stout | 300 | 3.00-6.00 | 5.00-10 | 2.00-3.00 | 4.00-6.00 |
| ARGONAUT<br>233 E. Colfax | 160 | 4.00 | 5.50 | 2.00 | 3.00 |
| AUDITORIUM<br>14th & Stout | 200 | 2.00-3.50 | 3.00-5.00 | 1.50-2.00 | 2.50-3.00 |
| AYRES<br>1441 Logan | 75 | 3.50 up | 5.00-6.00 | 2.50 | 4.00 |
| BROWN PALACE<br>17th & Tremont | 300 | 5.00 up | 8.00 up | | |
| COLBURN<br>10th & Grant | 100 | 3.50-5.00 | 5.00-8.00 | | |
| COLORADO<br>17th & Tremont | 100 | 2.50-3.00 | 4.00-5.00 | 1.50-2.00 | 2.50-3.00 |
| COSMOPOLITAN<br>18th & Broadway | 460 | 3.00-5.00 | 5.00-10.00 | 1.50-2.00 | 2.50-4.00 |
| CREST<br>1924 Welton | 114 | 2.00 up | 3.00 up | 1.50 | 2.00 |
| EDELWEISS<br>1651 California | 76 | 3.00 | 4.00 | 2.00 | 3.00 |
| HARVARD<br>501 E. Colfax | 60 | 2.50 | 3.50 | 1.50 | 2.50 |
| KENMARK<br>530 17th | 120 | 2.50-3.50 | 4.00-6.00 | 1.50-2.50 | 2.50-4.00 |
| LANCASTER<br>1765 Sherman | 75 | 2.50 | 3.00-5.00 | 2.00 | 2.50 |
| MARQUETTE<br>1725 Curtis | 62 | 2.00 | 4.00 | 3.00 | 3.00 |
| MAYFLOWER<br>1710 Grant | 80 | 2.50-3.50 | 3.50-5.00 | 1.50-2.00 | 3.00-3.50 |

*(Continued on next page)*

| HOTEL | Rooms | Single with Bath | Double with Bath | Single without Bath | Double without Bath |
|---|---|---|---|---|---|
| MIDLAND 1106 17th | 70 | 3.00 | 4.00 | 1.50-3.00 | 2.00-3.00 |
| MILLS 1321 Logan | 60 | 2.50 | 4.00 | 1.50 | 2.00 |
| NEWHOUSE 1470 Grant | 77 | 3.00 | 5.00 | 2.00-2.50 | 3.00-3.50 |
| OLIN 1420 Logan | 125 | 2.50-4.00 | 6.00 | | |
| O'NEILL 1407 Stout | 60 | 2.00 | 3.50 | 1.50 | 2.50 |
| OXFORD 1612 17th | 250 | 3.50 | 5.00 | 2.00 | 3.50 |
| PAGE 1320 Stout | 65 | 2.00-2.50 | 3.00-3.50 | 1.50 | 2.00 |
| PARK LANE 450 S. Marion | | | 10.00 | | |
| PLAZA 330 15th | 60 | 2.00-2.50 | 3.00-3.50 | 1.50 | 2.00-2.50 |
| SEARS 1755 California | 94 | 2.50-3.00 | 3.00-8.00 | 2.00 | 2.50-3.00 |
| SHIRLEY-SAVOY 17th & Broadway | 400 | 3.00-5.00 | 5.00-8.00 | 2.00-2.50 | 3.50-4.00 |
| STANDISH 1530 California | 125 | 2.50 | 3.50 | 1.50 | 2.50 |
| WELLINGTON 1450 Grant | 75 | | 3.50 | | |
| WEST 1337 California | 112 | 2.50 | 3.50 | 1.25-1.50 | 2.00-2.50 |
| WYNNE 1431 California | 100 | 2.00 up | 3.00 up | 1.50 | 2.00 |
| WEST COURT 1415 Glenarm Place | 129 | 2.50 up | 3.00 up | 1.50 | 2.00 |

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